C/041/002 Incoming
#4202
K

Canyon Fuel Company, LLC
A Subsidiary of Arch Western Bituminous Group, LLC

Sufco Mine
597 South SR24
Salina, Utah 84654
(435) 286-4880
Fax (435) 286-4499

October 17, 2012

File in:
☐ Confidential
☐ Shelf
☒ Expandable
Date Folder 101812 C/ 0410002
Incoming

Utah Coal Program
Utah Division of Oil, Gas & Mining
1594 West North Temple, Suite 1210
P. O. Box 145801
Salt Lake City, UT 84114-5801

Re: Canyon Fuel Company, LLC, Sufco Mine, Permit Number C/041/0002 response to Task #4150 Northwater Mitigation Plan.

Dear Permit Supervisor:

The Canyon Fuel Company, LLC, Sufco Mine (Sufco or Mine) is pleased to submit this response to the Utah Division of Oil, Gas and Mining (DOGM or Division) Deficiency Letter (Task #4150) dated August 13, 2012 regarding the North Water Mitigation Plan. Sufco includes in this letter a response to each of the deficiencies noted by the Division and a description of the location within the amendment where the responses may be found. Please note the current mitigation plan has been expanded to address issues related to the ongoing drought conditions occurring in the central Utah area.

Deficiency List

RECEIVED
OCT 18 2012
DIV. OF OIL, GAS & MINING

April Abate (AA)
Ingrid Campbell (IC)
Daron Haddock (DH)
James Owen (JO)

R645-301.320: CFC chose not to respond to this deficiency previously. The Division will not approve the application until it has been responded to. Please revise the appendix 7-25 and remove statements regarding impacts to vegetation. Currently, there is no quantitative data to support the claim that the riparian vegetation has not been impacted. Qualitative data, such as photos, is not adequate to conclude that riparian vegetation has not been impacted. The area could be becoming dominated by non-riparian vegetation which would not be discernible from photos. (IC)

Sufco has revised appendix 7-25 and removed any statements regarding impacts to vegetation.

R645-301.742.312.4 and -301.750: The Division considers the routing of water from the spring a diversion of flow from an undisturbed area. Therefore, under this rule the Permittee is required to comply with all local, state and Federal laws and regulations including the requirement to obtain a water right for the water being put to use for beneficial use. Currently there is no specific water right on spring M-SP80. However, a change application would be required to add this spring as a point of diversion. The USFS currently holds the water rights associated with the drainage that M-SP89

reports to and would be responsible for the filing of this new point of diversion. Until a change application is filed on this spring as a point of diversion, the Division cannot approve the plan. (DH & AA)

Sufco has provided information and maps requested by the USFS to aid in filing the new point of diversion at M-SP89 for the North Water Mitigation Plan. The USFS has submitted the application for the new point of diversion with Water Rights.

R645-301.764-765 & -301.800: Reclamation costs for the piezometers were not itemized in the bonding cost calculations spreadsheets included in Appendix 5-9. The company will need to provide the Division with an updated bond calculation spreadsheet including the costs of reclamation for the piezometers. (AA & JO)

The updates to the bond calculations are included with this submittal as Northwater Mitigation and will be added to Appendix 5-9 in Volume 6 of the MRP.

Attached are the Division C-1 and C-2 forms and Appendix 7-25 Northwater Mitigation Plan. Sufco appreciates the Division's consideration of this submittal as a viable mitigation plan for the North Water Spring area. If you have any questions or need additional information, please contact Amanda Richard at (435) 286-4489.

Sincerely,
CANYON FUEL COMPANY, LLC
SUFCO Mine

Kenneth E. May
General Manager

KEM
Encl.

cc: DOGM - Price Field Office
DOGM Correspondence File
Sufpub\Govt2012\dogmmrp\Northwater 2ndResponse.ltr.doc

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: CANYON FUEL COMPANY, LLC
Mine: SUFCO MINE
Permit Number: C/041/0002
Title: 2012 Northwater Mitigation Plan- Third Submittal

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

Add	Replace	Remove	DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☒	☐	☐	Northwater Mitigation Plan, in Appendix 7-25 in Volume 8 of MRP
☐	☒	☐	Replace Bond Calculation Pages: Total2068 Page 1, Demo2068 Page 1, in Appendix 5-9
☐	☐	☐	in Volume 6 of MRP
☒	☐	☐	Bond Calculation Page: Demo2068 Page 66, in Appendix 5-9 in Volume 6 of MRP
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Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	Received by Oil, Gas & Mining

APPLICATION FOR COAL PERMIT PROCESSING

Permit Change ☒ New Permit ☐ Renewal ☐ Exploration ☐ Bond Release ☐ Transfer ☐

Permittee: CANYON FUEL COMPANY, LLC
Mine: SUFCO MINE **Permit Number:** C/041/0002
Title: 2012 Northwater Mitigation Plan- Third Submittal

Description, Include reason for application and timing required to implement:
Third submittal of mitigation plan for the Northwater Spring Area

Instructions: If you answer yes to any of the first eight questions, this application may require Public Notice publication.

☐ Yes ☒ No 1. Change in the size of the Permit Area? Acres: _____ Disturbed Area: _____ ☐ increase ☐ decrease.
☐ Yes ☒ No 2. Is the application submitted as a result of a Division Order? DO# _____
☐ Yes ☒ No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes ☒ No 4. Does the application include operations in hydrologic basins other than as currently approved?
☐ Yes ☒ No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?
☐ Yes ☒ No 6. Does the application require or include public notice publication?
☐ Yes ☒ No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☐ Yes ☒ No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes ☒ No 9. Is the application submitted as a result of a Violation? NOV # _____
☐ Yes ☒ No 10. Is the application submitted as a result of other laws or regulations or policies?
Explain: _____
☐ Yes ☒ No 11. Does the application affect the surface landowner or change the post mining land use?
☐ Yes ☒ No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)
☐ Yes ☒ No 13. Does the application require or include collection and reporting of any baseline information?
☐ Yes ☒ No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☐ Yes ☒ No 15. Does the application require or include soil removal, storage or placement?
☐ Yes ☒ No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☐ Yes ☒ No 17. Does the application require or include construction, modification, or removal of surface facilities?
☐ Yes ☒ No 18. Does the application require or include water monitoring, sediment or drainage control measures?
☐ Yes ☒ No 19. Does the application require or include certified designs, maps or calculation?
☐ Yes ☒ No 20. Does the application require or include subsidence control or monitoring?
☒ Yes ☐ No 21. Have reclamation costs for bonding been provided?
☐ Yes ☒ No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes ☒ No 23. Does the application affect permits issued by other agencies or permits issued to other entities?
☐ Yes ☒ No 24. Does the application include confidential information and is it clearly marked and separated in the plan?

Please attach three (3) review copies of the application. If the mine is on or adjacent to Forest Service land please submit four (4) copies, thank you. (These numbers include a copy for the Price Field Office)

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

KENNETH E. MAY (Print Name) GENERAL MANAGER (Position) 10/17/12 (Date) _____ (Signature (Right-click above choose certify then have notary sign below))

Subscribed and sworn to before me this 17 day of October, 2012

Notary Public: _____, state of Utah.

My commission Expires: _____
Commission Number: _____
Address: _____
City: _____ State: _____ Zip: _____

} ss:

JACQUELYN NEBEKER
Notary Public
State Of Utah
My Commission Expires 3/24/2015
Commission# 606049

For Office Use Only:	Assigned Tracking Number:	Received by Oil, Gas & Mining

Form DOGM- C1 (Revised December 10, 2007)

Appendix 7-25

North Water Mitigation Plan

Background

During 2005 and 2006, longwall mining at Canyon Fuel Company, LLC's Sufco Mine occurred beneath the North Water Canyon tributary to the East Fork of Box Canyon (also often referred to as the East Fork of the East Fork of Box Canyon) (Figure 1). Subsidence related effects apparently resulted in the cessation of spring discharge to the land surface from three springs in the North Water Canyon area (Pines 105, Pines 311, and Pines 310 lower). Longwall mining and related subsidence also occurred beneath the Joe's Mill Pond area, approximately ½ mile south of North Water Canyon (Figure 2). Subsequent to mining in the Joe's Mill Pond area, discharge from a seep that provided water to an adjacent small stock watering pond also ceased to flow at the ground surface.

Since that time Sufco has conducted and submitted several studies and potential mitigation plans to the Division to restore water at the affected areas, all these plans and studies with the exception of the report from the 2009 drilling actives have been submitted, therefore this report is included as Attachment A. These plans have included installation of piezometers to monitor ground water levels in the alluvium in the canyon bottoms, potential water collection systems, wells, and the final plan submitted in 2010 to pipe water from a spring several miles away. Several of these plans have been determined to be inadequate to provide an adequate amount of water to satisfy the mitigation needs.

Sufco has taken steps to provide water for the Emery County Stock Grower Association (permittees) in the North Water and Joe's Mill Pond areas. In the summer of 2009 Sufco installed a submersible solar pump in the perennial flowing section of the East Fork of Box Canyon that delivered water to the sump at Pines 105 in North Water Canyon. This system allowed the permittees who have the grazing permit in the area to install their solar pump and pump water to their troughs on the canyon rim as they had done prior to the undermining of the area. As part of this project, Sufco also installed two additional trough locations to allow for better foraging in the Pines area. One of the sets of troughs is located on the canyon rim directly above Sufco's pump. The other set is located to the east and utilizes the permittees pump to fill them as well as the troughs currently located above Pines 105 (Figure 3).

The configuration of the system is as follows. Solar panels on the canyon rim power a submersible solar pump that is placed in the East Fork of Box Canyon at a location designated as EFB-11 in the original steam monitoring program. A pipeline runs from the pump to a set of two 750 gallon troughs on the rim. A float system closes off a valve to these troughs once they are full. This pushes water into a pipeline that runs back into the bottom of the canyon to the permitties' sump in the fenced off area surrounding Pines 105. A new pipeline was installed that runs from this sump to the existing troughs at Pines 105 and the far east troughs. The permitties' pump and panels are used to fill these two sets of troughs. When the troughs above

Pines 105 are full a float system shuts off a valve allowing water to be pumped to the last set of troughs to the east. This system was installed in 2009 but not utilized until the fall of 2011 due to the allotment not being grazed as a result of vegetation manipulations that the Forest Service conducted in the area.

In the fall of 2011 the permitties were allowed to graze that area as they moved their cattle off the mountain for the year. In anticipation of this Sufco installed the in stream pump and restored water to the sump at Pines 105. However the permitties never installed their pump to complete the system. Inquires with permitties found that installation of the surface pump at Pines 105 was difficult due to size and weight of the pump.

The aforementioned water delivery system was presented by Sufco to DOGM, Division of Water Rights, Forest Service and the Emery County Stock Growers Association in October and November of 2011. At that time, the mine understood the Emery County Stock Growers, Forest Service, and DOGM agreed in principle the water delivery system satisfied a portion of the mitigation for the loss of surface flows within North water Canyon. However, the continued drought conditions that have persisted in the Pines area for several years have caused the mine to reconsider the mitigation plan and modify it accordingly. More in the general region, had been significantly reduced as a result of a lack of snow pack development during the winter of 2011-2012. Flows in the East Fork of Box Canyon at EFB-11 were barely adequate, and more frequently inadequate, to allow the existing pumping system to function.

Mitigation Plan

Sufco understands the mitigation required for the loss of surface water in the Northwater area is, in part, maintaining water to the two troughs on the canyon rim above the Pines 105 spring and to the Joe's Mill Pond area for the time period in which livestock are grazing the allotment. Water from Pines 310 Upper supplemented by other small seeps in the canyon provides sufficient water for wildlife in the area of the Pines 310 and 311 seeps, downstream water rights have not been affected and the Division has concluded that no material damage has occurred. Also, the land-use has remained unchanged since undermining occurred, meaning that wildlife and recreation still occur in the area and with this plan livestock grazing is maintained.

As part of the mitigation plan, Sufco will construct a system to transport water from spring MSP-89 to the existing pump and piping system at EFB-11 in the East Fork of Box Canyon (Figure 4). This will provide the necessary water for the existing system to deliver water to the water troughs for livestock use in Pines Pasture. MSP-89 is located on the north-facing slope between the main stem and East Fork of Box Canyon. The spring is approximately 400 feet below the canyon rim, about midway down the slope. MSP-89 has been monitored periodically

by Sufco since 2001 and the average flow is around 20 gallons per minute (gpm), Table 1. Sufco will divert 10-15 gpm from MSP-89 to supplement the water to be pumped to the North Water area and at Joe's Mill Pond areas during grazing allotment use.

MSP-89 Flow Data		
Date (m/yr)	**Flow (gpm)**	**Sampler**
Oct-01	15-20 (est.)	C. Hansen
Apr-02	28	C. Hansen
Aug -02	20	C. Hansen
Sep-06	30.4	E. Petersen
May-10	20	E. Petersen
May-10	20	E. Petersen
Oct- 11	30	E. Petersen
Jun-12	15	L. Roberts/A. Richard
Jun-12	20	A. Richard

Table 1 MSP-89 Flows

The final mitigation plan will use a solar pump, solar panels and coupled or fused 2" HDPE pipe to deliver water from MSP-89 to EFB-11. Sufco will construct a spring collection box at MSP-89 to temporarily collect a majority of the flow. The water would then be diverted into a second enclosed box that would house a solar powered electric pump, with an overflow structure to direct excess water back into the spring area. Solar panels would be placed on the canyon rim above MSP-89 to power to the pump. From the second box, the water would be sent through the 2" HDPE waterline. The waterline will be delivered by helicopter and run on the surface by hand or horse. Little to no disturbance is expected. The waterline would contour the west-canyon wall to EFB-11, where it will be connected into the waterlines already in place. This system would provide water to the two troughs located on the canyon rim above EFB-11 and the two troughs located at Joe's Mill Pond.

Sufco will install all required equipment to pump water from MSP-89 and protect this equipment from damage from livestock wildlife to the extent possible. This may include but not be limited to the following: a mounting pole and fencing for solar panels, cement pad to mount pump on, fencing at the spring site to protect the pump and plumbing from livestock disturbance.

Sufco will provide and maintain for life of mining the following:

- Solar pump at MSP-89
- Solar panels to power pump at spring
- Water lines between trough locations
- Water troughs at the 2 locations (those installed by Sufco at rim of the canyon and Joes Mill Pond)
- Bi-weekly inspections of the equipment, while in operation, will be made and adjustment to the system to ensure an adequate volume of water is being delivered will be made as soon as possible.
- For a s long as required and reasonable, Sufco will provide in the annual report the water level measures obtained from the piezometers in the Northwater Spring Canyon and Joe's Mill areas.

During the first year of operation of the pumping and piping system, a monthly report will be provided to the Division and the Forest Service. The report will include an estimate of the water delivered to the troughs, an assessment of the pump efficiency and operation times, as well as a general description of the overall performance of the system. Problems and their solutions will also be described in the report. During the second year of operation, a summary report of the systems performance and maintenance will be included in the mine's annual report.

Upon completion of all mining activities at Sufco, perpetual maintenance of the system will be discussed and agreed on between the Division, the Forest Service and Sufco. Furthermore, Sufco will negotiate with the Forest to perform mitigation activities at another site within the Muddy or Quitchupah drainages that may include vegetation enhancement, spring collection improvement, fencing of sensitive areas, etc. The negotiations and mitigation project will be completed before the end of year 2017.

Sufco will install all plumbing, waterlines and fencing prior to the next use of the area by livestock. This is currently anticipated to be in November of 2012.

Reclamation

Final reclamation of the water delivery system will consist of the removal of the solar panels, pumps, pipe lines and associated equipment. The piezometers that were constructed in Northwater Spring Canyon, Joes's Mill Pond area, and associated canyon rims will be removed or plugged and abandoned in accordance with state regulations. Reclamation costs have been included with this submittal and will be placed in appendix 5-9 in volume 6 of the MRP.

Three years prior to cessation of mining at Sufco, the water delivery system will be evaluated for effectiveness and functionality. Negotiations may be entered into at that time with the

mine, the permit holders, the Forest, and the Division to determine the future operation and maintenance of the system and if this is the best technology currently available to continue to deliver water for livestock grazing. Solutions for the long term liability of the system will be part of those negotiations.

Also three years prior to cessation of mining, the hydrologic condition of the Northwater area will be evaluated. A report will be compiled describing the current conditions of surface and groundwater systems as well as the changes that have occurred since mining took place in the area. At this time, all mitigation efforts associated with this project will be appropriately evaluated to determine effectiveness and conformity with the rules and regulations. The ultimate goal of the evaluations will be to determine compliance with final bond release of the project.

Attachment A

Results of Well Drilling and Slug Testing of Castlegate Sandstone Bedrock Monitoring Wells in the North Water Canyon and Joes Mill Pond Areas, Canyon Fuel Company, LLC, Sufco Mine C/041/002

Results of Well Drilling and Slug Testing of Castlegate Sandstone Bedrock Monitoring Wells in the North Water Canyon and Joes Mill Pond Areas, Canyon Fuel Company, LLC, SUFCO Mine C/041/002

4 April 2010

Canyon Fuel Company, LLC
Sufco Mine
Salina, Utah

PETERSEN HYDROLOGIC, LLC
CONSULTANTS IN HYDROGEOLOGY

Results of Well Drilling and Slug Testing of Castlegate Sandstone Bedrock Monitoring Wells in the North Water Canyon and Joes Mill Pond Areas, Canyon Fuel Company, LLC, SUFCO Mine C/041/002

4 April 2010

Canyon Fuel Company, LLC
SUFCO Mine
Salina, Utah

Prepared by:

Erik C. Petersen, P.G.
Senior Hydrogeologist
Utah P.G. No. 5373615-2250

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Results of Well Drilling and Slug Testing of

Castlegate Sandstone Bedrock Monitoring Wells

In the

North Water Canyon and Joes Mill Pond Areas,

Canyon Fuel Company, LLC, SUFCO Mine C/041/002

1.0 Introduction

During July and August of 2009, Canyon Fuel Company, LLC commissioned the drilling of five drill holes in the Castlegate Sandstone bedrock in the North Water Canyon and Joes Mill Pond areas overlying their Sufco Mine (Figure 1). The purpose of this drilling program was to further characterize groundwater systems in the Castlegate Sandstone and to evaluate the potential for production of groundwater from the Castlegate Sandstone for use in the mitigation of diminished groundwater flows that have occurred in the area subsequent to undermining and subsidence.

Previous investigations regarding groundwater and surface-water systems and the effects of mining subsidence on the hydrologic balance in the North Water Canyon and Joes Mill Pond areas have been performed. In 2006, Canyon Fuel commissioned Petersen Hydrologic, LLC to perform a hydrogeologic investigation of alluvial and shallow bedrock groundwater systems and subsidence-related impacts in the North Water Canyon and Joes Mill Pond

areas. In January 2007 a report of this investigation, including proposed mitigation activities, was prepared and submitted to the Utah Division of Oil, Gas and Mining. This report is entitled *Investigation of Subsidence-Related Impacts to Groundwater Systems in the North Water and Joes Mill Pond areas and Proposed Groundwater Mitigation Activities, Sufco Mine,* dated 29 January 2007 (Petersen Hydrologic, 2007a).

In November, 2007, an additional hydrologic investigation was performed in the North Water Canyon and Joes Mill Pond areas. A report summarizing the findings of that investigation is entitled: *Report of 2007 Hydrogeologic Field investigations; Supplemental information for the report: Investigation of Subsidence- Related Impacts to Groundwater Systems in the North Water and Joes Mill Pond areas and Proposed Groundwater Mitigation Activities, Sufco Mine,* dated 7 November, 2007 (Petersen Hydrologic, 2007b). This report was also submitted to the Utah Division of Oil, Gas and Mining.

The reader is referred to these documents for additional information on the geologic and hydrogeologic conditions and on the effects of mining-related activities in the North Water Canyon and Joes Mill Pond areas.

The purpose of this investigation is to present the results of the 2009 drilling program and to provide an analysis of the potential to produce groundwater from the bedrock formations underlying the North Water Canyon and Joes Mill Pond areas.

Including this introduction, this report contains the following sections:

- Methods of Study
- Presentation of Data
- Hydrogeologic Conditions
- Conclusions and Recommendations
- References Cited
- Appendices

2.0 Methods of Study

- The well drilling operations were performed by Lang Exploratory Drilling of Salt Lake City, Utah using continuous coring techniques. The five drill holes were drilled using HQ sized drilling equipment and a polymer-based drilling fluid. Drilling supervision and geologic logging of the drilling cores were performed by Mr. Craig Clement of Clement Drilling and Geophysical, Inc. of Cedar Hills, Utah. The drill cores were placed in core boxes and stored at the Salina, Utah offices of Canyon Fuel Company, LLC for future analysis.

- One-inch diameter PVC monitoring wells were installed in each of the five drill holes to allow the monitoring of water levels and for aquifer testing. The construction of the monitoring wells was supervised by Mr. Craig Clement of Clement Drilling and Geophysical, Inc., who is a Utah State licensed water well driller. Subsequent to the

construction of the wells, the wells were developed using surging and bailing techniques.

- Water levels in the five monitoring wells were monitored periodically after their construction using an EnviroTech model 500 water-level meter.

- Slug testing was performed on wells NW1-09, NW2-09, NW4-09, and JMP-09 on 6 November 2009. Slug testing was performed by rapidly introducing water into the well casing. Declining head levels during the slug testing were then monitored using an In-Situ Inc. brand LevelTROLL 500 model pressure transducer/data logger. A preliminary injection test was performed on well NW3-09. However, based on the results of the initial injection test, slug testing was not performed on well NW3-09.

- Slug test results were calculated using methods described by Hvorslev (1951).

3.0 Presentation of Data

The locations of the five Castlegate Sandstone bedrock monitoring wells are shown on Figure 1. A north-south cross-section through the North Water Canyon area is provided as Figure 2. Monitoring well completion data are depicted graphically in Figure 3. Completion information for the five monitoring wells is provided in tabular form in Table 1. Water level measurements for the wells are presented in Table 2. Slug test results are presented in Table 3. Geologic logs of the drill core from the five drill holes are presented in Appendix A.

Calculations and assumptions used in computing the slug test results are provided in Appendix B.

4.0 Hydrogeologic Observations

As indicated on Table 1, the five drill holes range in depth from 168 to 228 feet below the ground surface. Each of these holes penetrates some distance into the Blackhawk Formation, which directly underlies the Castlegate Sandstone in the North Water Canyon and Joes Mill Pond areas. It is noteworthy that the screened intervals for all of the five monitoring wells are all or in part located in the Blackhawk Formation as summarized below.

—	Feet of well screen in the Castlegate Sandstone	Feet of well screen in the Blackhawk Formation	Percentage of screen in Castlegate Sandstone	Saturated thickness of Castlegate Sandstone*
NW1-09	0	40	0	1.2
NW2-09	3.8	16.2	19	18.3
NW3-09	0.5	19.3	3	4.5
NW4-09	5	15	25	2.3
JMP-09	11	29	37	7

*Note: Saturated thickness assumes unconfined conditions; water levels measured in November 2009 and February 2010. Figures are approximate.

Slug testing activities performed and the results of the slug tests on the four bedrock monitoring wells tested are summarized below.

It should be noted that while the conditions in the monitoring wells varied, the conditions strictly required to perform valid slug testing were not present in any of the wells. The conditions in the four tested monitoring wells are summarized below.

	Water level above well screen (required for valid test)	Water level above sand pack (required for low-K valid test)	Screened in Castlegate or Blackhawk
NW1-09	Yes	No	Blackhawk
NW2-09	Yes	No	Composite (almost all Blackhawk)
NW4-09	No	No	Composite (mostly Blackhawk)
JMP-09	No	No	Composite (mostly Blackhawk)

It is apparent from the information above that none of the wells met the criteria required for a valid slug test. Conditions at NW1-09 and NW2-09 were invalid because a portion of the sand pack was unsaturated, while the testing of wells NW4-09 and JMP-09 were invalid because an appreciable portion of the sand pack was above the water level and the well screens were partially above the water level. However, slug testing results were calculated for each of these four monitoring wells for general evaluative purposes. It should be noted that under the best of circumstances, slug tests are generally considered useful for making

order-of-magnitude determinations of hydraulic conductivity. Accordingly, this information should be considered in light of the less-than-optimal conditions that existed in the wells. The slug test results should be considered approximations only. Additionally, because of the nature of the completions of the wells (i.e., the well screened intervals are all or mostly in the Blackhawk Formation), it is should be noted that the hydraulic conductivity values reported above are not indicative of conditions in the Castlegate Sandstone.

	Hydraulic Conductivity* (well slotted screen length assumption)	Hydraulic Conductivity* (screen length equals sand pack length assumption)
NW1-09	1.56×10^{-5} cm/sec	8.13×10^{-6} cm/sec
NW2-09	1.41×10^{-4} cm/sec	5.94×10^{-5} cm/sec
NW3-09	Not tested	Not tested
NW4-09	2.11×10^{-4} cm/sec	1.04×10^{-4} cm/sec
JMP-09	2.04×10^{-4} cm/sec	1.55×10^{-4} cm/sec

*Note: As described in previous sections, one or more conditions required for a valid slug test were not present in the wells.

The values of hydraulic conductivity presented above were calculated using the Hvorslev (1951) method. The results listed in the first column were calculated using the assumption that the length of the well screen is equal to the physical length of slotted well screen (commonly assumed when slug testing in high-permeability strata. The results listed in the second column were calculated using the assumption that the screen length equals the total

length of the gravel pack. This assumption is commonly employed when testing low-permeability strata.

The order of magnitude estimates for hydraulic conductivity presented above for wells NW1-09 and NW2-09 are consistent with published values for sandstone bedrock (Freeze and Cherry, 1979). The hydraulic conductivity values for wells NW4-09 and JMP-09 are somewhat greater (near the upper end of the range for sandstone). It seems probable that the hydraulic conductivity values presented for these two wells are less reliable than are the other two wells tested. As depicted in Figure 3, the completion characteristics for these two wells are not favorable for a valid slug test. Additionally, as shown in Appendix B, the response of well JMP-09 during the slug test recovery period did not follow a typical well response pattern.

Based on the information above, it is apparent that there is only a limited thickness of saturated sandstone in the Castlegate Sandstone in the vicinity of the monitoring wells in the North Water Canyon and Joes Mill Pond areas. This observation is important, as it has previously been determined that, while there is a reasonable potential to produce moderate quantities of groundwater from fractured Castlegate Sandstone, there is a much more limited potential to produce useful quantities of groundwater from the Blackhawk Formation. This condition is principally related to the fact that permeable strata in the Blackhawk Formation commonly exist as lenticular, discontinuous sandstone channel deposits. These Blackhawk Formation sandstone channel deposits are typically encased vertically and horizontally by low permeability rocks. Consequently, while individual sandstone channels may be

permeable and contain water (often ancient), the potential for groundwater recharge to these sandstone channel deposits is low. Thus, while wells screened in Blackhawk Formation sandstones may initially yield modest quantities of water, the potential for long-term sustainability of the groundwater source is probably not good. It should be noted, however, that there may be a greater potential to produce groundwater from sandy strata in the uppermost Blackhawk Formation in the North Water Canyon and Joes Mill Pond areas if the sandstone strata directly underlying the Castlegate Sandstone is appreciably fractured.

5.0 Conclusions and Recommendations

Because the conditions in the wells do not satisfy all the requirements for valid slug testing, the results presented here are provided for general purposes only and should be evaluated in light of the limitations of the testing. Additionally, because of the locations of the well screened intervals, the characteristics indicated by the slug tests are generally not indicative of conditions in the Castlegate Sandstone.

The potential for the production of moderate quantities (a few gallons per minute) of groundwater from unfractured Castlegate Sandstone bedrock in the North Water Canyon and Joes Mill Pond areas is considered low. This is because of the limited saturated thickness of Castlegate Sandstone observed in the vicinity of the monitoring wells (from about 1 to 18 feet). If an attempt is made to produce groundwater from the Castlegate Sandston, the area of greatest potential seems to be near well NW2-09, which has the greatest saturated

thickness of Castlegate Sandstone of any of the wells (~18 feet). Because of the likely unsatisfactory long-term performance of a well screened in unfractured Blackhawk Formation rocks, such a production well is not recommended.

Alternatively, if an area of known subsidence fracturing could be intercepted, there may be increased potential for groundwater production from the base of the Castlegate Sandstone or possibly from the uppermost Blackhawk Formation if the strata in the well location were to be appreciably fractured and the fracture network was well interconnected with adjacent areas. The locations of subsidence fractures has been mapped in the area previously by Canyon Fuel Company, LLC (Petersen Hydrologic, 2007b).

4.0 References Cited

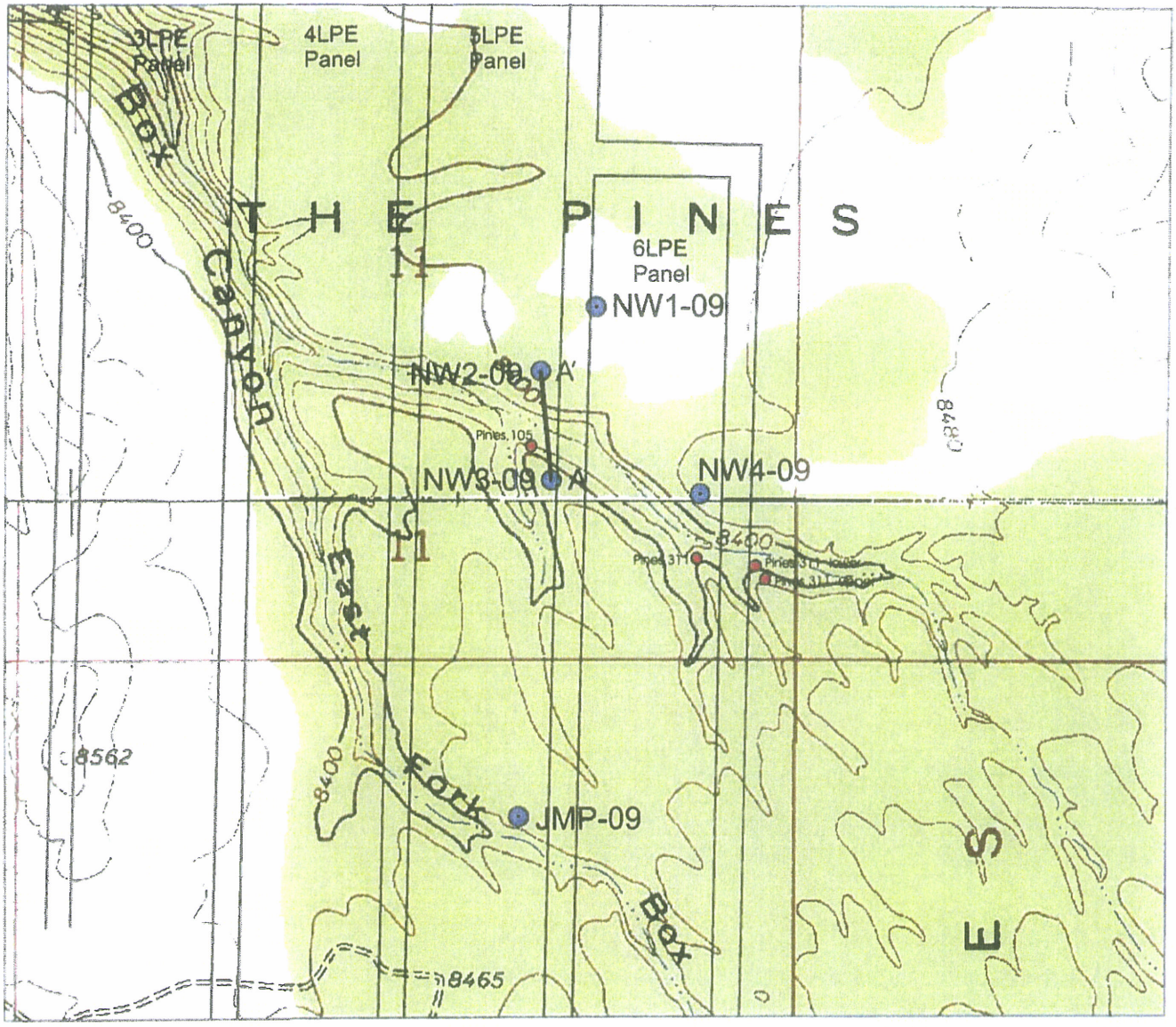
Freeze, R.A., and Cherry, J.C., 1979, Groundwater, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 604 p.

Hvorslev, M.J., 1951, Time lag and soil permeability in ground water observations, U.S. Army Corps of Engineers Waterways Experimental Station, Bulletin 36, 50 p.

Petersen Hydrologic, LLC, 2007a, Investigation of subsidence-related impacts to groundwater systems in the North Water and Joes Mill Pond areas and proposed

groundwater mitigation activities, Sufco Mine, unpublished consulting report for Canyon Fuel Company, LLC.

Petersen Hydrologic, LLC, 2007b, Report of 2007 Hydrogeologic field investigations; supplemental information for the report: investigation of subsidence- related impacts to groundwater systems in the North Water and Joes Mill Pond areas and proposed groundwater mitigation activities, Sufco Mine, unpublished consulting report for Canyon Fuel Company, LLC.



Note: longwall panel locations are approximate.

Figure 1 Locations of Castlegate Sandstone monitoring wells in the North Water Canyon area (see Figure X for cross-section A - A').

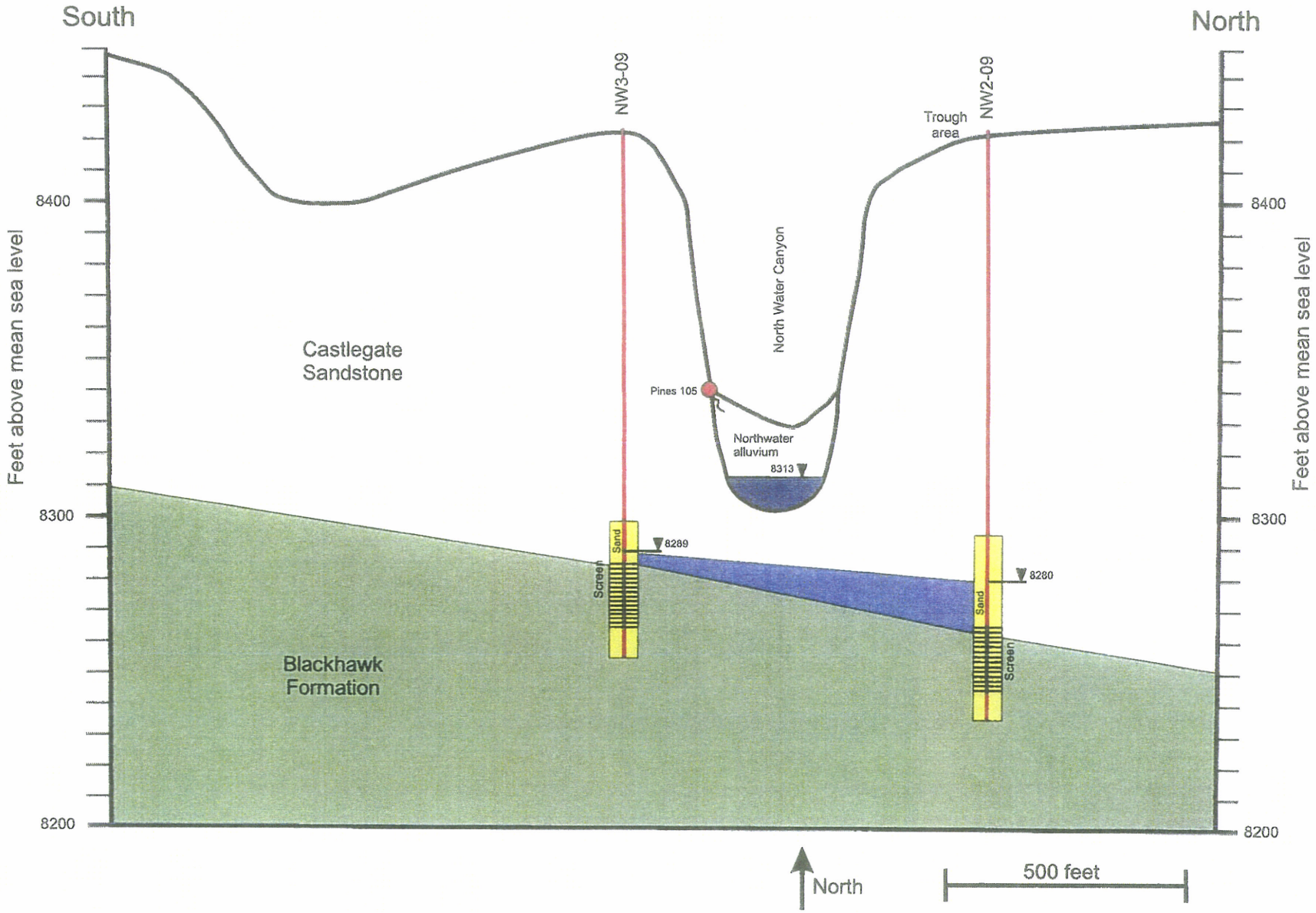


Figure 2 North-south cross-section through the North Water Canyon area (see Figure 2 for cross-section location).

NW2-09

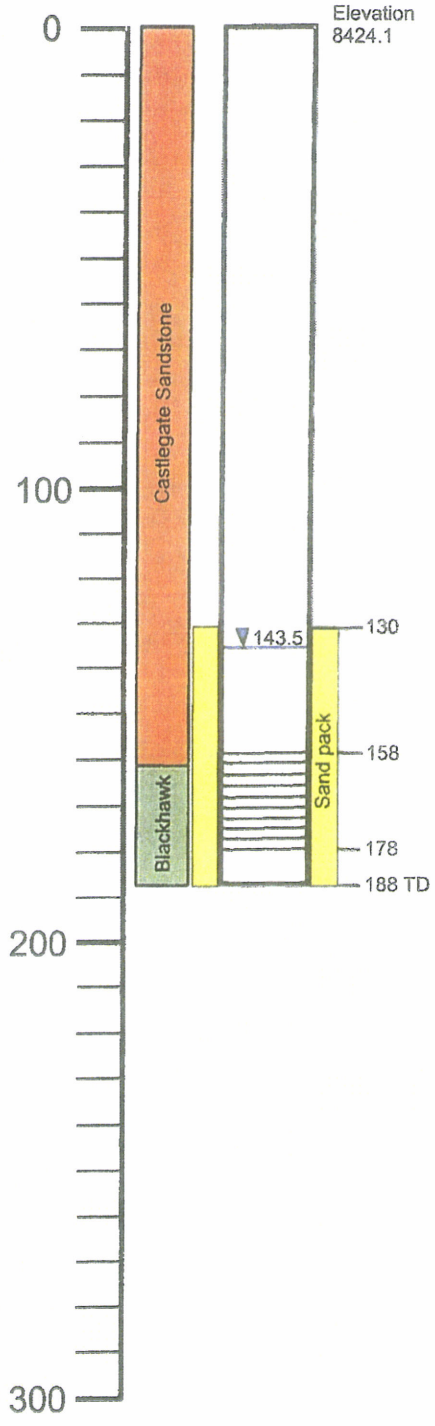


Figure 3b Construction details for NW2-09

NW1-09

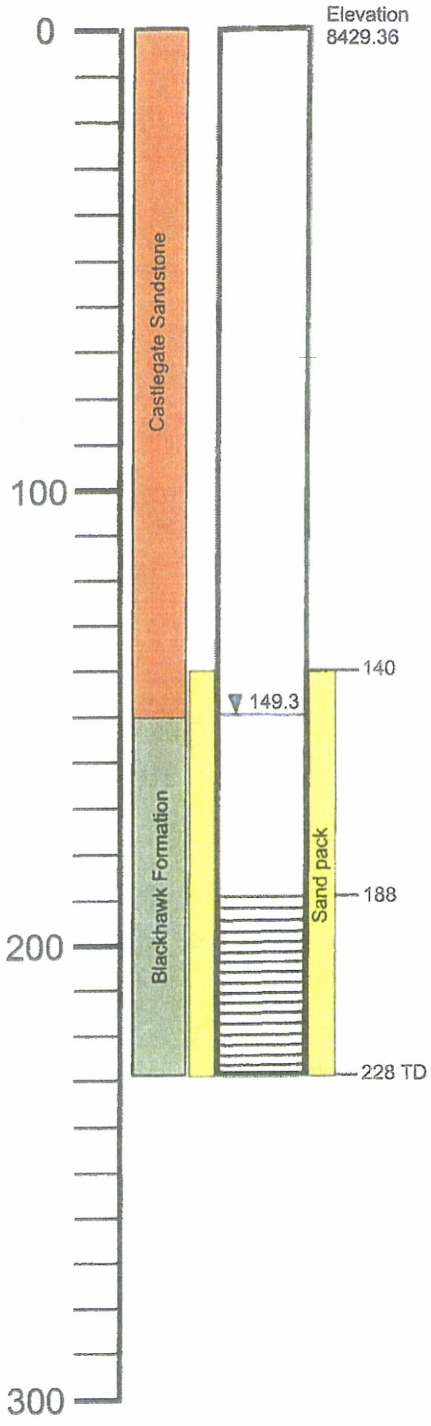


Figure 3a Construction details for NW1-09

NW3-09

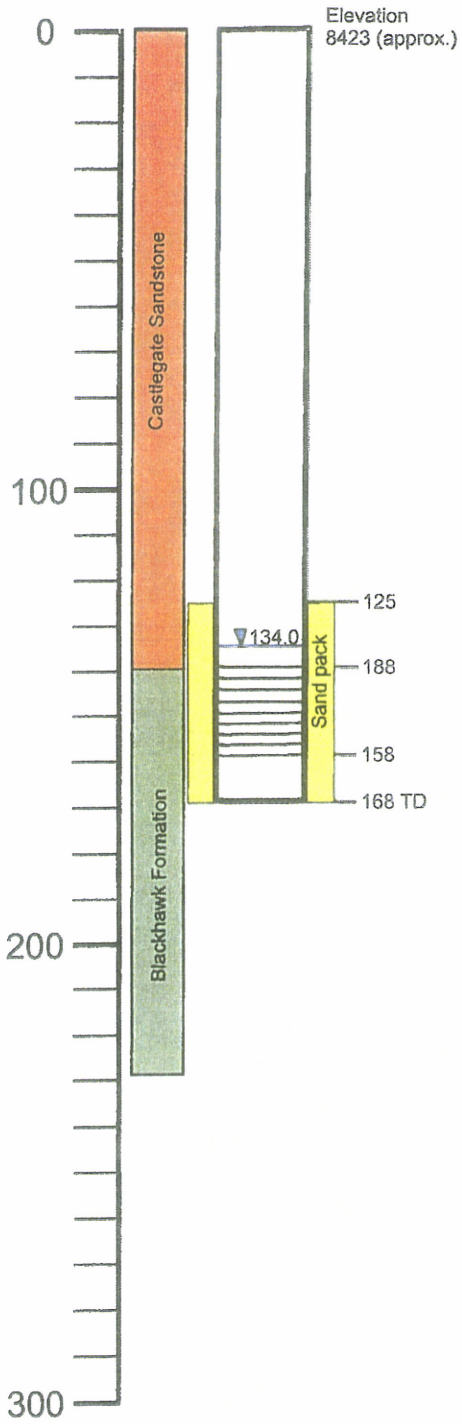


Figure 3c Construction details for NW3-09

NW4-09

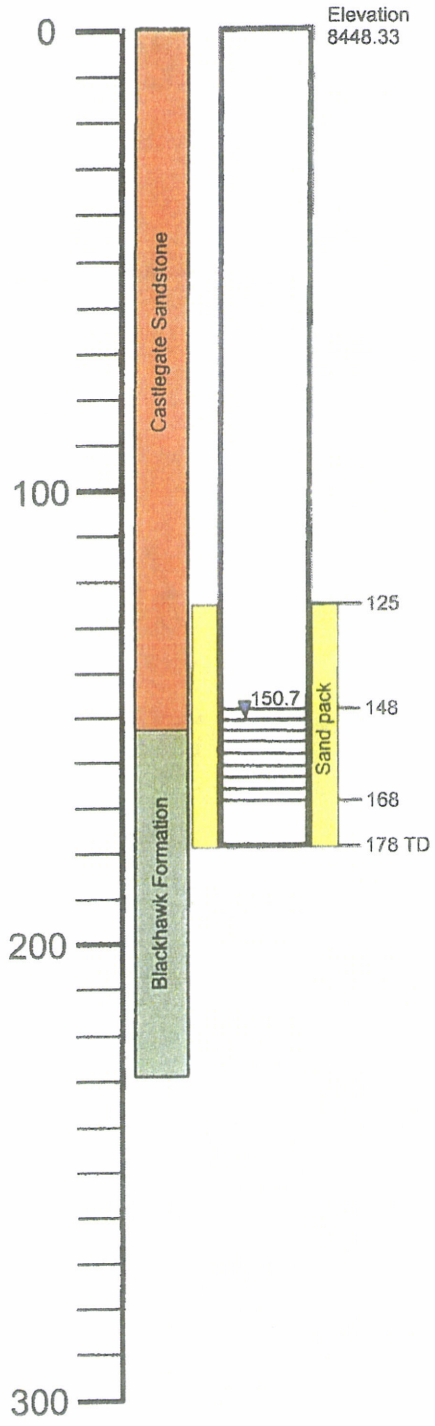


Figure 3d Construction details for NW4-09

JMP-09

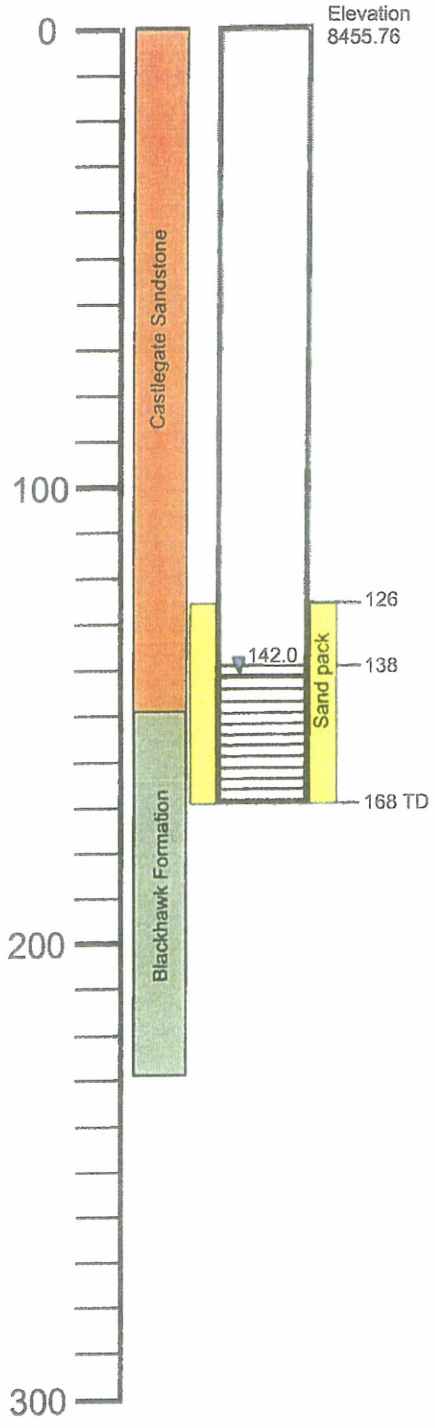


Figure 3e Construction details for JMP-09

Table 1 Completion information for Castlegate Sandstone monitoring wells.

	NW1-09	NW2-09	NW3-09	NW4-09	JMP-09
Well depth (feet below surface)	228	188	168	178	168
Well borehole diameter (feet)	0.333	0.333	0.333	0.333	0.333
Well casing ID (feet)	0.0833	0.0833	0.0833	0.0833	0.0833
Well screen from (feet below ground surface)	188	158	138	148	138
Well screen to (feet below ground surface)	228	178	158	168	168
Well screen length (feet)	40	20	20	20	30
Sand pack from (feet below ground surface)	140	130	125	130	126
Sand pack to (feet below ground surface)	228	188	168	178	168
Sand Pack length (feet)	88	58	43	48	42
Well screen slot size	0.010	0.010	0.010	0.010	0.010
Depth to Castlegate/Blackhawk contact (feet)	150.5	161.8	138.5	153	149
Static water level - 11/09 and 2/10 (feet below top of cas	149.27	143.54	134.02	150.73	142.01

Note: All wells drilled in July and August 2009

Table 2 Water level measurements from Castlegate Sandstone monitoring wells.

	28-Aug-09	11-Sep-09	6-Oct-09	2-Nov-09	4-Nov-09	6-Nov-09	12-Feb-10
NW1-09	148.86	148.21	148.49	148.57	149.27	---	---
NW2-09	143.94	143.07	143.44	143.55	143.45	143.38	---
NW3-09	133.78	---	---	---	---	---	134.02
NW4-09	151.60	150.35	---	150.49	150.41	152.13	---
JMP-09	144.89	149.1	145.11	139.21	138.78	142.01	---

Note: All measurements are in feet relative to top of PVC casing.

Table 3 Slug test results for Castlegate Sandstone monitoring wells.

	Hydraulic Conductivity* (well slotted screen length assumption)	Hydraulic Conductivity* (screen length equals sand pack length assumption)
NW1-09	1.56×10^{-5} cm/sec	8.13×10^{-6} cm/sec
NW2-09	1.41×10^{-4} cm/sec	5.94×10^{-5} cm/sec
NW3-09	Not tested	Not tested
NW4-09	2.11×10^{-4} cm/sec	1.04×10^{-4} cm/sec
JMP-09	2.04×10^{-4} cm/sec	1.55×10^{-4} cm/sec

*Note: One or more conditions required for a valid slug test were not present in each of the tested wells.

Appendix A

Geologic Logs

Appendix B

Slug Testing Information

Appendix A Hvorslev Method slug test calculations.

Hvorslev Equation for slug test:
$K = r^2 \ln (L/R) / 2LT_o$

K = hydraulic conductivity
r = radius of well casing
R = radius of well screen
L = length of well screen
T_o = time it takes for the water level to fall to 37% of the initial change

Assumptions: specified screen length, screen diameter = 4 inches

	r (feet)	R (feet)	L (feet)	T_o (seconds)
NW1-09	0.0417	0.167	40	232
NW2-09	0.0417	0.167	20	45
NW4-09	0.0417	0.167	20	30
JMP-09	0.0417	0.167	30	22.5

Hydraulic Conductivity values (feet/second)

NW1-09	5.13E-07	ft/sec
NW2-09	4.62E-06	ft/sec
NW4-09	6.93E-06	ft/sec
JMP-09	6.69E-06	ft/sec

Hydraulic Conductivity values (centimeters/second)

NW1-09	**1.56E-05**	**cm/sec**
NW2-09	**1.41E-04**	**cm/sec**
NW4-09	**2.11E-04**	**cm/sec**
JMP-09	**2.04E-04**	**cm/sec**

Appendix A Hvorslev Method slug test calculations.

Hvorslev Equation for slug test:
$K = r^2 \ln (L/R) / 2LT_o$

K = hydraulic conductivity
r = radius of well casing
R = radius of well screen
L = length of well screen
T_o = time it takes for the water level to fall to 37% of the initial change

Assumptions: Sand pack = screen length, 4-inch casing diameter

	r (feet)	R (feet)	L (feet)	T_o (seconds)
NW1-09	0.0417	0.167	88	232
NW2-09	0.0417	0.167	58	45
NW4-09	0.0417	0.167	48	30
JMP-09	0.0417	0.167	42	22.5

Hydraulic Conductivity values (feet/second)

NW1-09	2.67E-07	ft/sec
NW2-09	1.95E-06	ft/sec
NW4-09	3.42E-06	ft/sec
JMP-09	5.09E-06	ft/sec

Hydraulic Conductivity values (centimeters/second)

NW1-09	**8.13E-06**	**cm/sec**
NW2-09	**5.94E-05**	**cm/sec**
NW4-09	**1.04E-04**	**cm/sec**
JMP-09	**1.55E-04**	**cm/sec**

Appendix A Hvorslev Method slug test calculations.

Hvorslev Equation for slug test:
$K = r^2 \ln (L/R) / 2LTo$

K = hydraulic conductivity
r = radius of well casing
R = radius of well screen
L = length of well screen
T_o = time it takes for the water level to fall to 37% of the initial change

Assumptions: Specified screen length, screen diameter = 1 inch

	r (feet)	R (feet)	L (feet)	T_o (seconds)
NW1-09	0.0417	0.167	88	232
NW2-09	0.0417	0.167	58	45
NW4-09	0.0417	0.167	48	30
JMP-09	0.0417	0.167	42	22.5

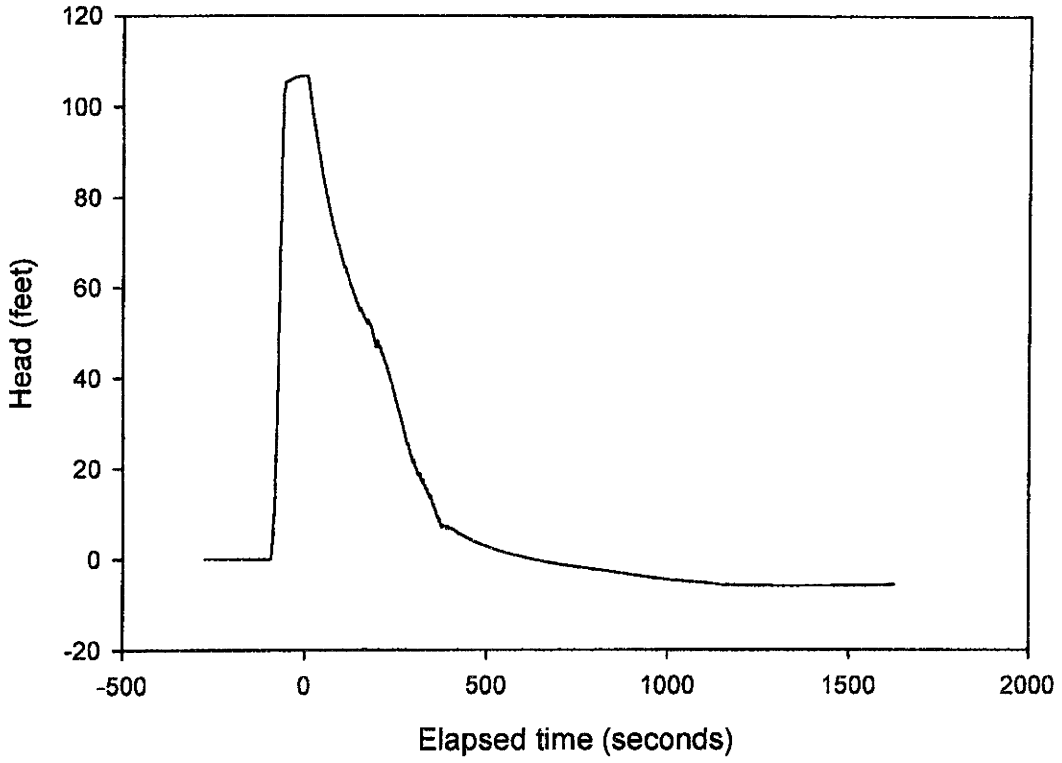
Hydraulic Conductivity values (feet/second)

NW1-09	2.67E-07	ft/sec
NW2-09	1.95E-06	ft/sec
NW4-09	3.42E-06	ft/sec
JMP-09	5.09E-06	ft/sec

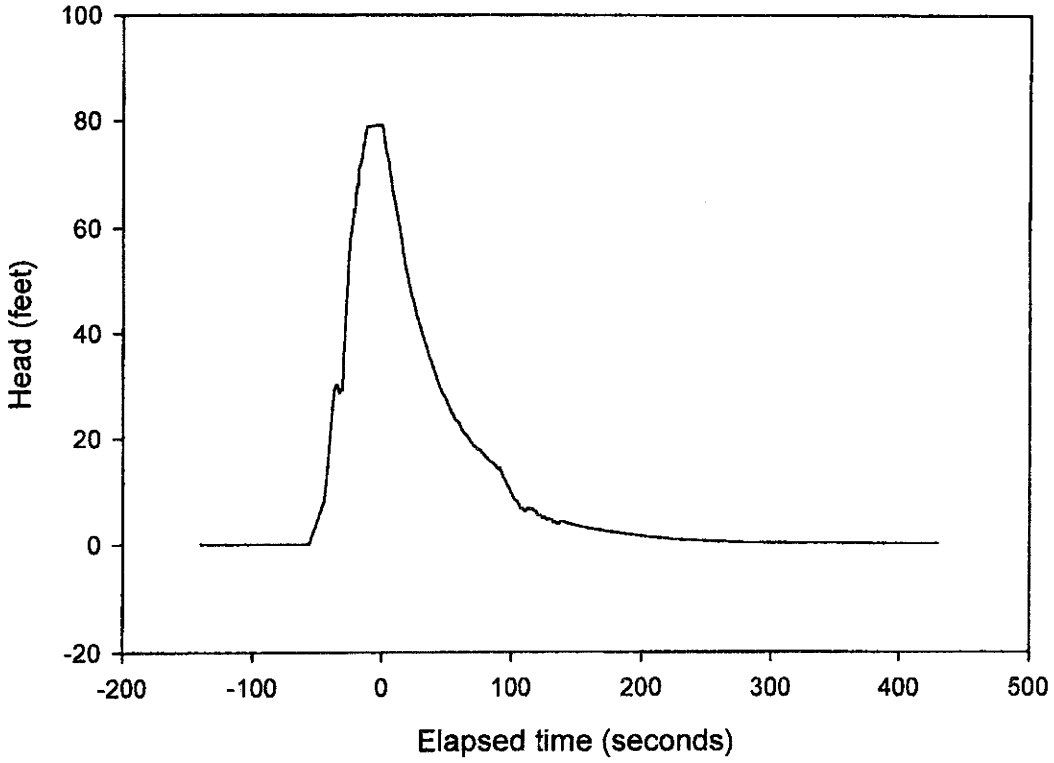
Hydraulic Conductivity values (centimeters/second)

NW1-09	**8.13E-06**	**cm/sec**
NW2-09	**5.94E-05**	**cm/sec**
NW4-09	**1.04E-04**	**cm/sec**
JMP-09	**1.55E-04**	**cm/sec**

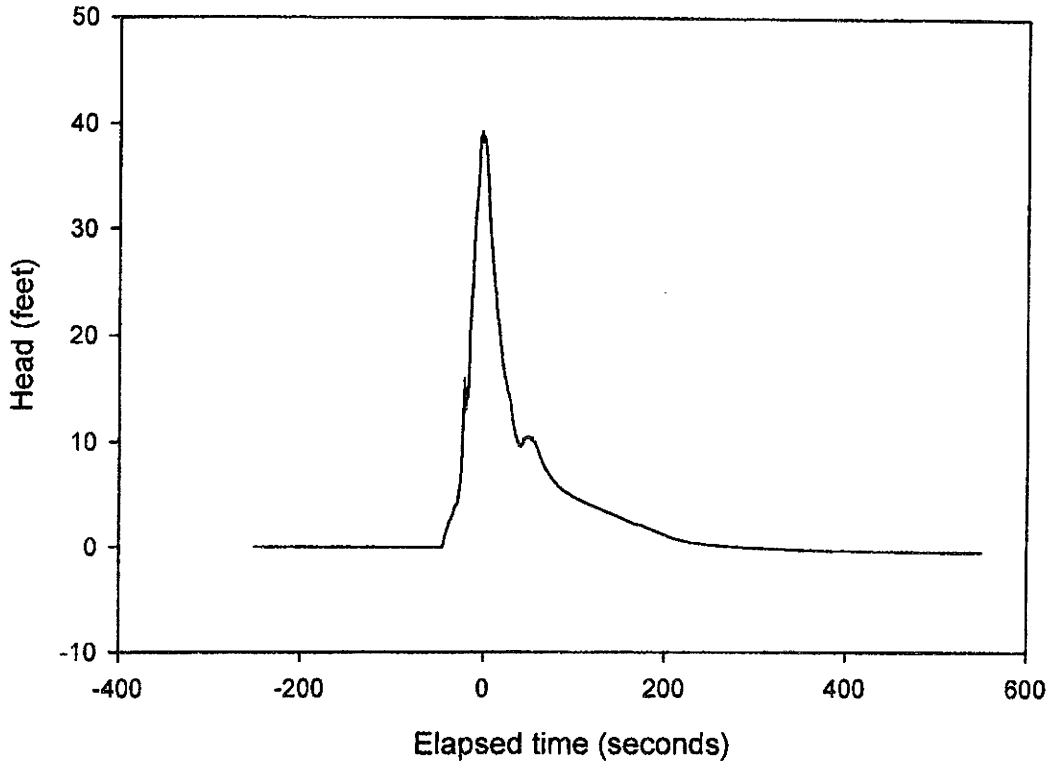
NW1-09 Slug Test



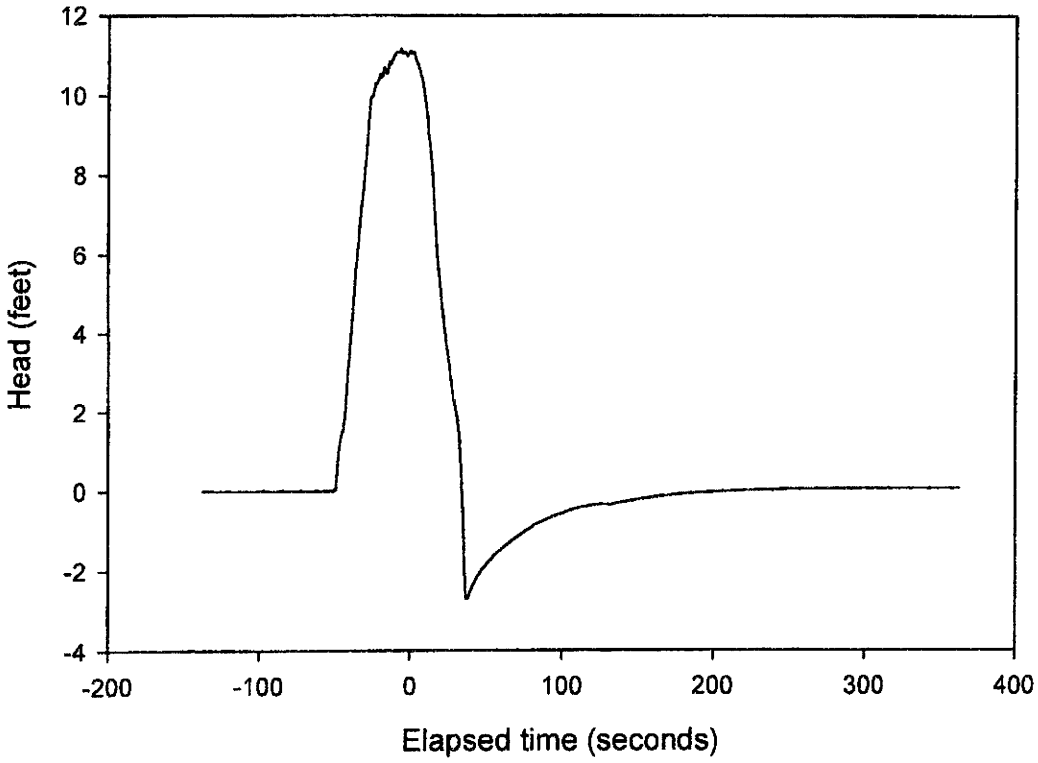
NW2-09 Slug Test



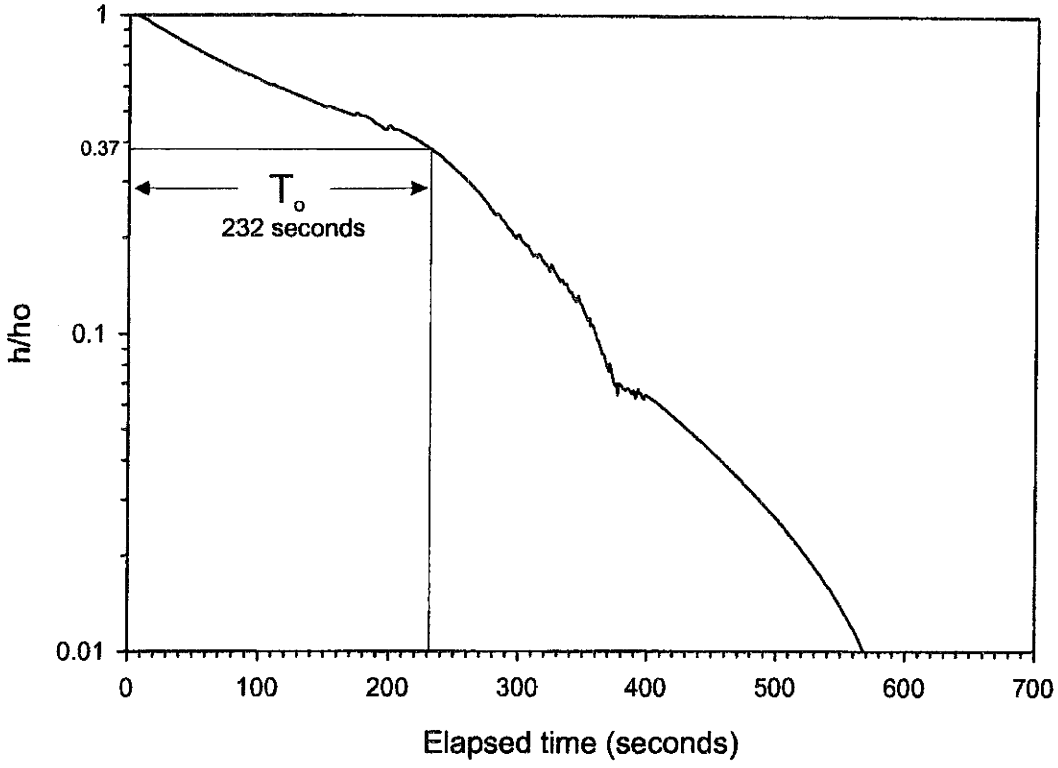
NW4-09 Slug Test



JMP-09 Slug Test



NW1-09 Hvorslev h/ho plot



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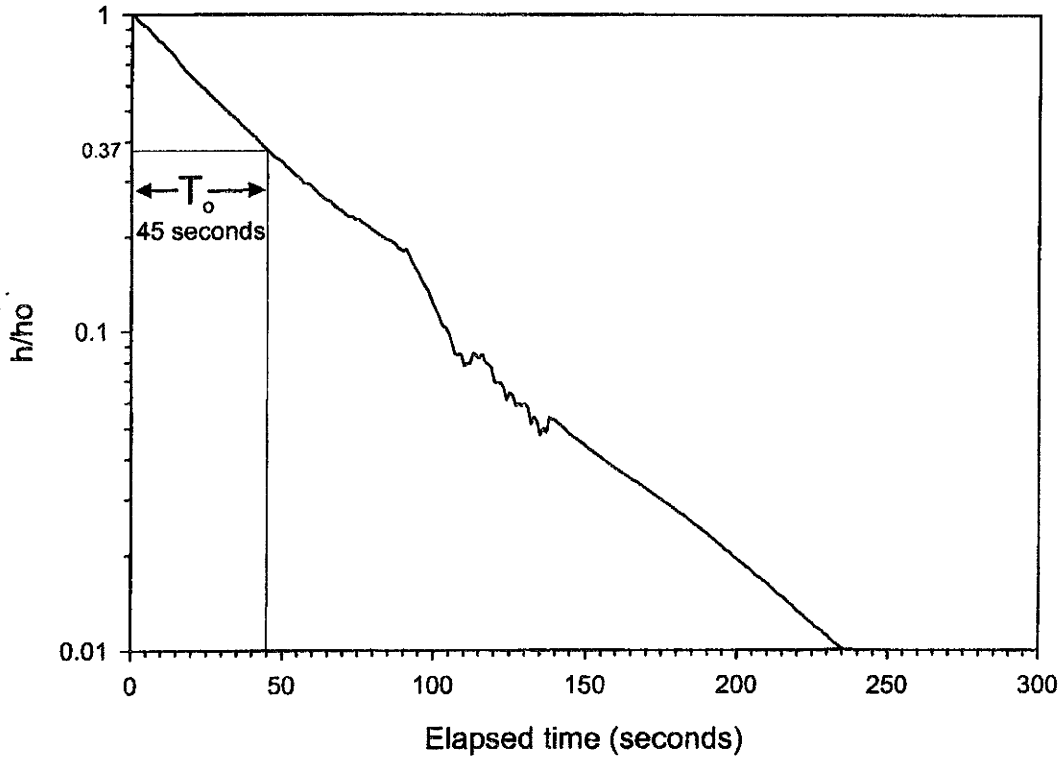

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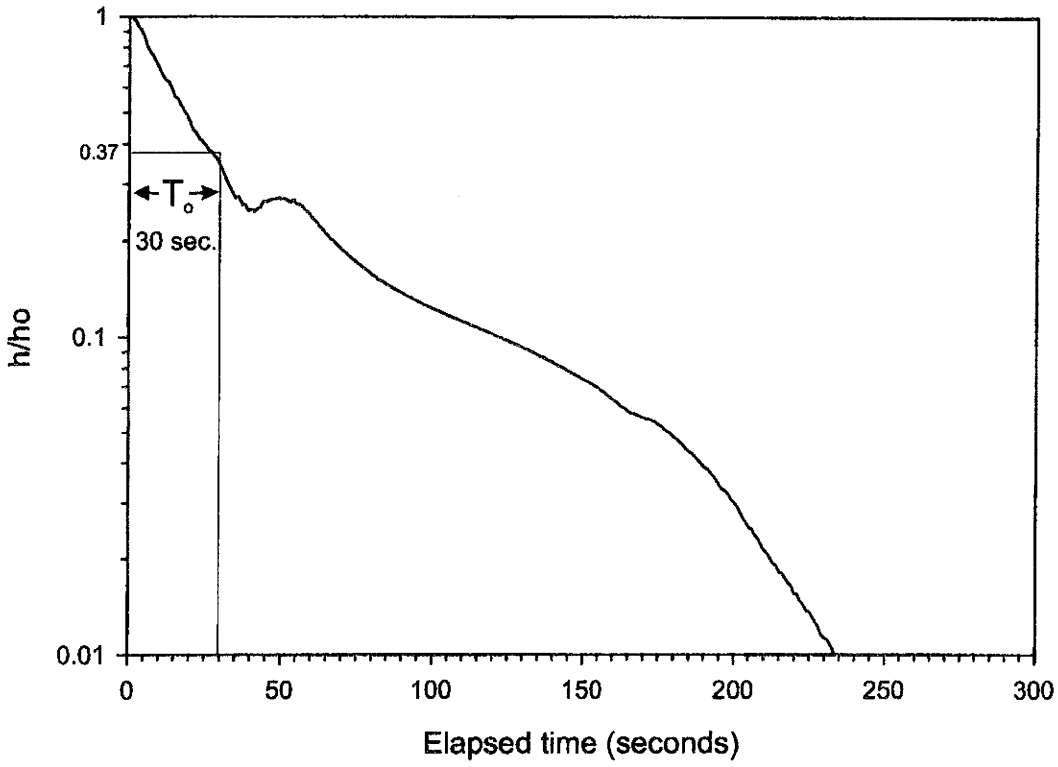

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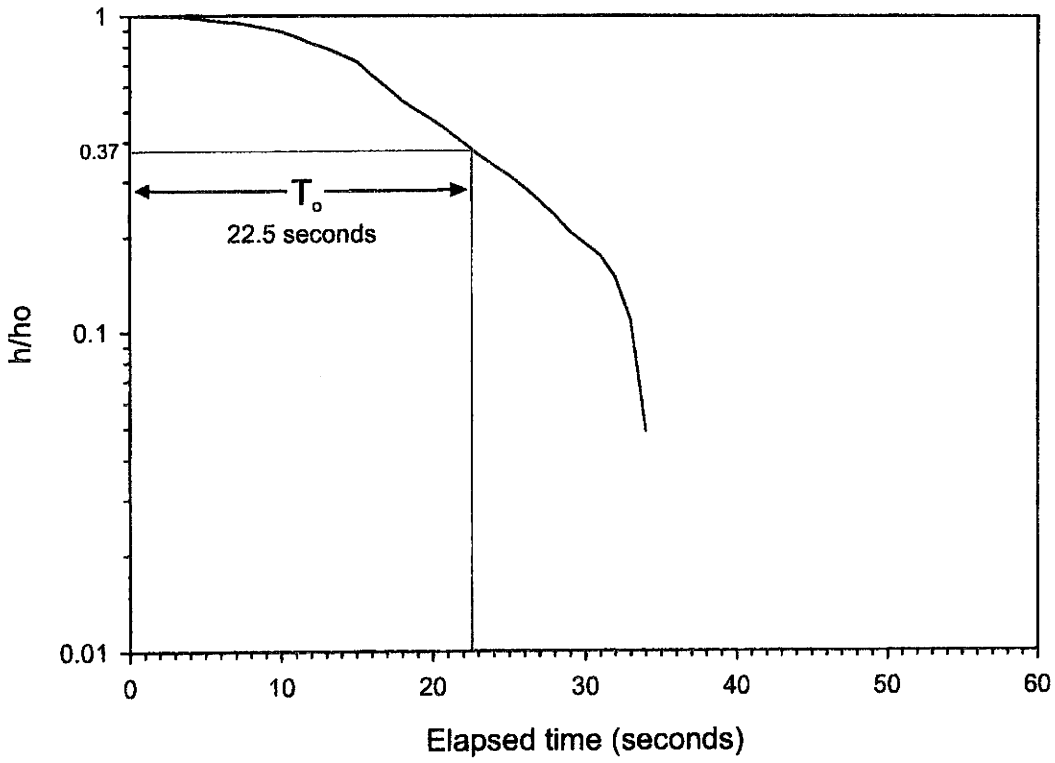

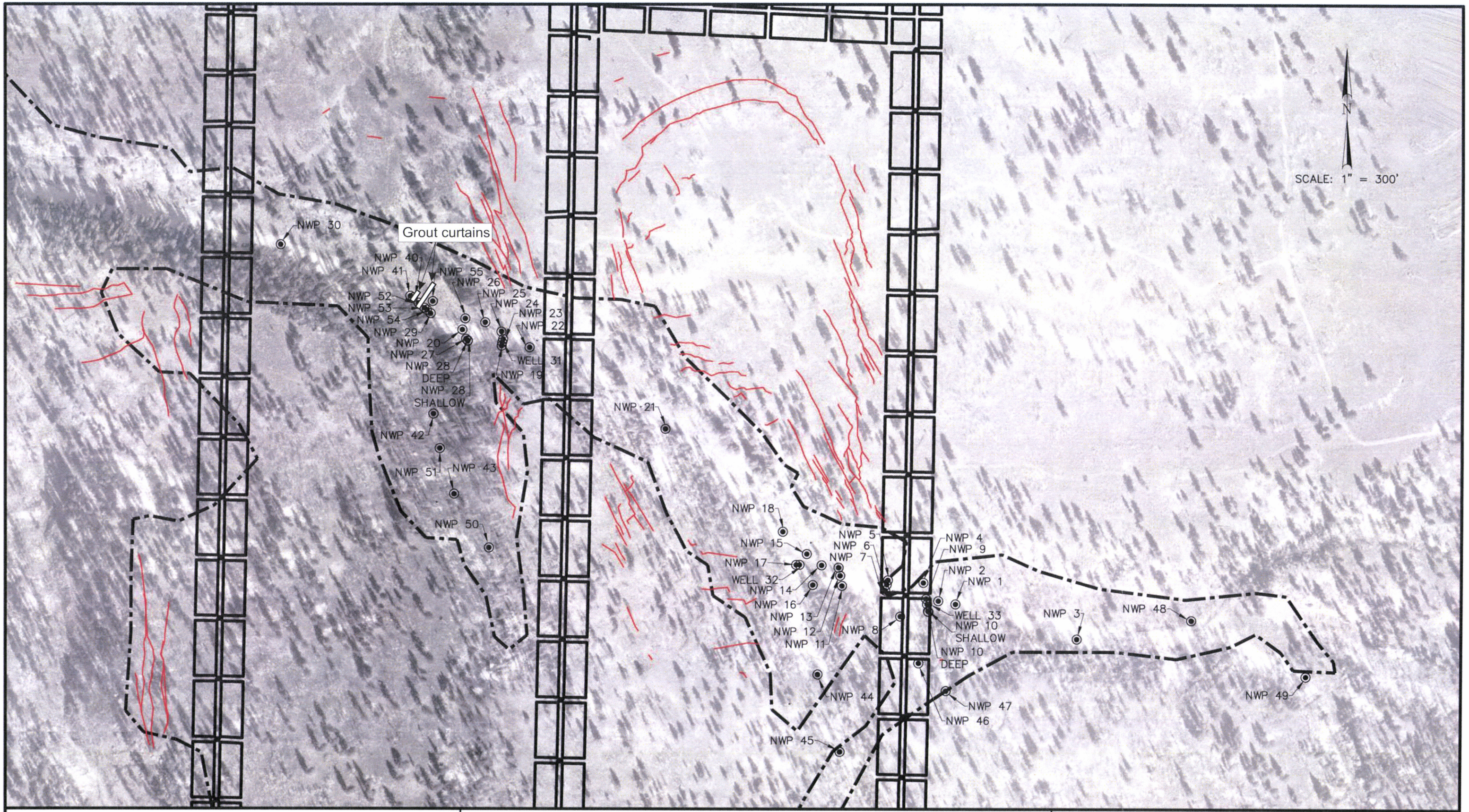

Canyon Fuel Company, LLC
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(435) 286-4880 Phone
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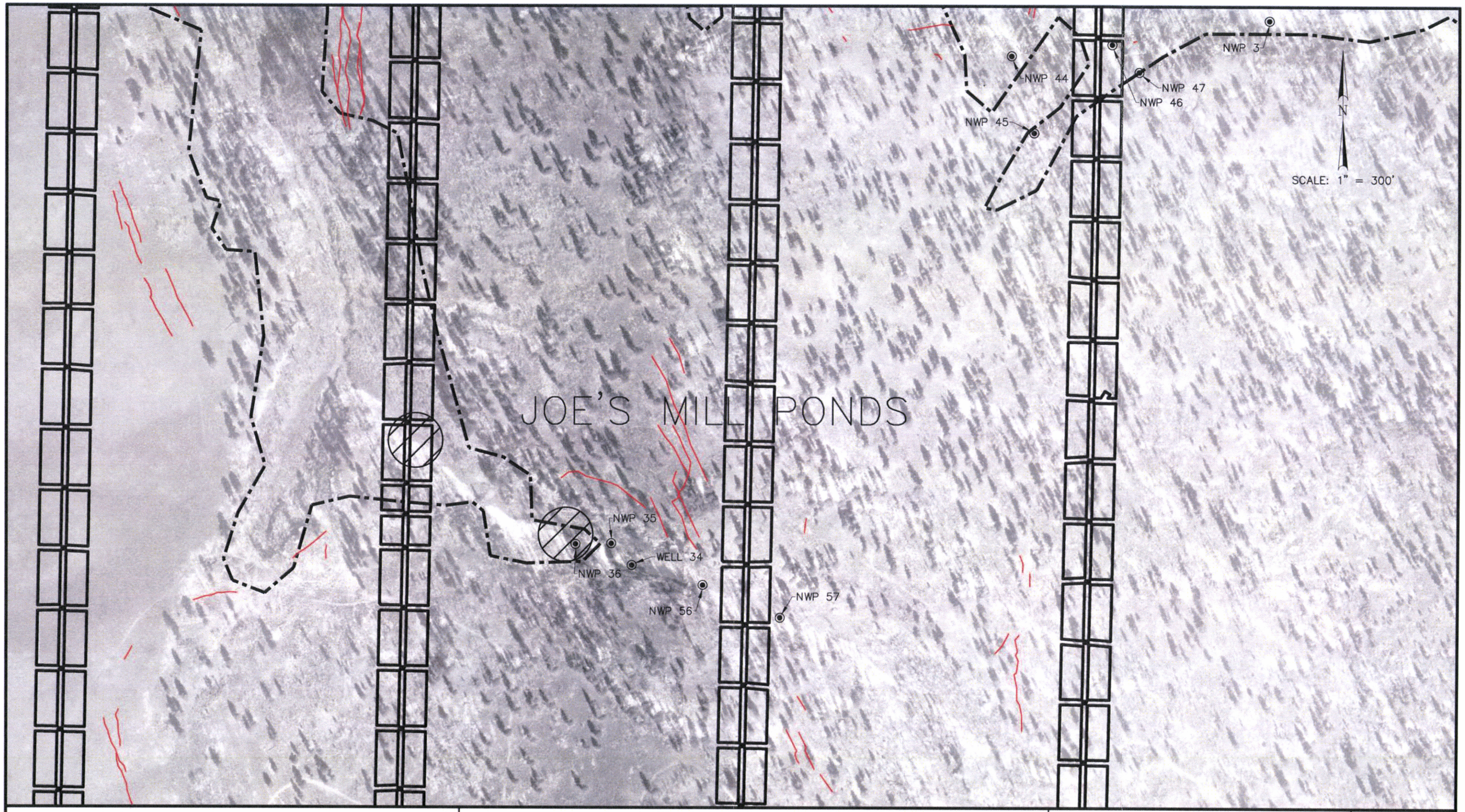
North Water Area

Subsidence Crack & Monitoring Well Locations

SCALE: 1" = 300'	DATE: Oct. 2007	DRAWN BY:K.B.B.	ENGINEER:M.L.D.	CHECKED BY:M.L.D.
FILE NAME: H:\				

REVISIONS					SHEET NO.
NO.	DATE	REQ. BY	DWG. BY	REMARKS	1

Figure 1 Locations of piezometers and grout curtains in the North Water Canyon area.



Canyon Fuel Company, LLC
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Joes Mill Area

Subsidence Crack & Monitoring Well Locations

SCALE: 1" = 300'	DATE: Sept. 2007	DRAWN BY: K.B.B.	ENGINEER: M.L.D.	CHECKED BY: M.L.D.
FILE NAME: H:\				

REVISIONS					SHEET NO.
NO.	DATE	REQ. BY	DWG. BY	REMARKS	1

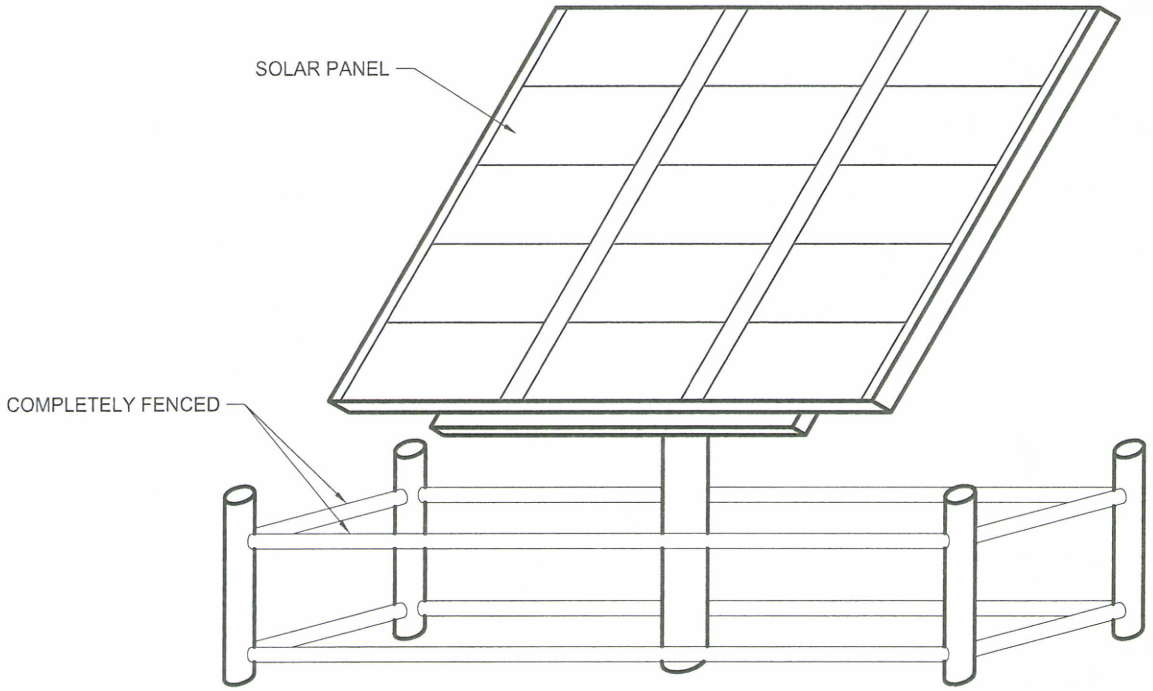
Figure 2 Locations of piezometers in the Joes Mill area.

Water level data for Sufco North Water and Joes Mill area piezometers.

PETERSEN HYDROLOGIC, LLC, North Water Piezometers water levels.xls

Measurements reported as depth to water in feet below top of PVC well casing.

	24-Aug-06	1-Sep-06	14-Sep-06	29-Sep-06	12-Oct-06	23-Oct-06	6-Nov-06	20-Nov-06	4-Dec-06	27-Apr-07	19-Jul-07	10-Aug-07	4-Oct-07	30-May-08	20-Jun-08	12-Sep-08	8-Nov-08	12-Jun-09	20-Sep-09	Nov-09	4-Jun-10	14-Sep-10	28-Oct-10	25-Jun-11	Sep-11	4-Nov-11
NWP-1	4.61	4.81	4.75	5.08	4.76	4.87	5.43	5.80	6.19	7.87	9.38	9.69	10.48		11.91	12.69	Frozen	13.73	14.47	14.77	14.53	15.37	15.64	12.75	13.86	14.11
NWP-2	3.15	3.39	3.63	3.91	3.65	3.75	4.37	4.80	5.23	7.10	8.35	8.61	9.20		10.33	11.27	11.67	12.32	13.04	13.27	12.99	13.79	14.00	11.27	12.25	12.51
NWP-3	11.36	11.41	11.42	11.44	11.34	11.32	11.25	11.29	11.46	11.13	12.21	12.74	14.07		13.25	15.06	15.47	15.40	Dry	Dry	Dry	Dry	Dry	11.83	15.38	15.58
NWP-4	3.55	3.71	4.34	4.67	4.40	4.46	5.13	5.57	6.03	8.25	9.46	9.67	10.34		11.04	11.86	11.89	13.62	14.21	14.38	14.44	14.96	15.23	11.64	13.61	14.03
NWP-5	2.93	3.06	5.45	6.15	6.02	6.15	6.82	7.25	7.79	9.82	10.21	10.35	10.76		12.26	12.66	13.02	14.99	15.35	15.64	16.09	16.63	16.86	13.00	13.57	13.82
NWP-6	3.08	3.24	5.51	6.06	5.85	5.73	6.37	6.55	7.08	9.85	10.34	10.45	11.04		12.5	12.91	13.25	14.30	14.55	14.7	14.89	15.18	15.31	12.66	13.81	14.07
NWP-7	3.41	3.54	6.40	7.26	7.21	7.44	8.00	8.86	8.92	10.85	11.23	11.43	11.93		13.57	14.02	14.35	15.10	15.32	15.44	15.66	15.89	15.94	14.33	14.53	14.67
NWP-8	8.77	8.78	9.50	9.82	9.88	9.49	9.74	10.24	10.61	14.42	15.10	15.35	16.05		17.55	17.93	18.62	19.37	19.63	19.84	20.43	20.58	20.71	19.88	19.46	19.73
NWP-9	2.79	2.98	3.53	3.84	3.59	3.69	4.30	4.76	5.28	7.30	8.48	8.71	9.27		10.06	10.96	11.36	12.32	12.95	13.14	12.90	13.65	13.90	11.21	12.24	12.49
NWP-10 shallow	3.39	3.60	3.71	3.91	3.64	3.79	4.50	4.95	5.41	6.88	7.73	7.77	9.41		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
NWP-10 deep	2.06	2.26	3.43	3.86	4.29	4.61	5.39	5.98	6.49	8.87	9.82	10.03	10.55		11.52	12.05	12.36	12.62	13.17	13.35	13.30	13.83	13.96	12.74	13.37	13.51
NWP-11	2.58	3.14	19.68	19.59	20.20	20.08	21.04	21.80	21.71	24.32	24.79	25.06	25.30		26.21	26.28	26.38	26.75	26.83	26.84	27.12	27.14	27.22	27.20	26.96	26.94
NWP-12	4.14	4.94	22.52	16.29	17.36	17.42	17.14	18.84	17.88	20.08	19.58	19.01	19.45		22.33	23.43	25.70	26.11	26.71	26.8	Dry	27.45	Dry	26.54	25.25	25.23
NWP-13	3.88	5.44	12.38	13.87	14.37	15.08	16.26	17.00	17.08	25.57	23.80	23.72	23.81		25.8	25.82	25.58	27.07	27.15	29.95	Dry	Dry	Dry	Dry	Dry	27.35
NWP-14	3.34	5.43	9.59	12.04	12.02	12.04	13.19	13.54	14.12	17.93	20.42	21.13	22.75		Dry	Dry	28.40	Dry	Dry	Dry	Dry	Dry	Dry	25.57	24.71	24.53
NWP-15	2.87	5.42	7.76	9.91	9.97	9.84	10.46	10.99	11.60	14.31	15.11	15.37	16.96		23.6	24.25	24.39	26.86	Dry	Dry	Dry	Dry	Dry	22.06	23.88	26.91
NWP-16	3.30	4.43	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
NWP-17	3.56	9.03	7.98	9.93	9.88	9.83	10.29	10.78	11.12	13.66	16.61	17.89	19.21		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
NWP-18	4.19	4.19	9.25	10.75	10.47	10.60	11.13	10.58	11.89	15.99	18.79	19.05	19.88		Dry	25.37	25.53	26.36	26.67	26.72	27.17	27.41	Dry	27.78	27.96	27.92
NWP-19	8.46	8.52	9.04	9.81	10.52	10.77	10.82	10.88	11.42	13.98	14.48	14.44	14.99		15.61	15.73	15.84	16.12	16.23	16.31	16.61	16.66	16.74	15.40	15.69	15.76
NWP-20	17.35	17.60	17.58	19.14	18.08	18.16	18.27	18.30	18.44	19.41	19.94	20.05	20.37		21.41	22.14	22.39	Dry	Dry	Dry	Dry	Dry	Dry	22.97	22.29	21.74
NWP-21	2.70	5.63	submerged	3.68	submerged	submerged	2.80	3.43	4.10		8.74	9.30	10.87		13.27	13.8	14.12	14.01	15.10	15.29	15.75	15.98	16.10	13.42	15.53	15.37
NWP-22	7.24	7.68	8.22	9.70	8.97	8.97	9.21	9.54	Cap frozen	11.91	12.30	—	13.08		14.79	14.87	15.30	16.35	16.57	16.72	17.38	17.45	17.50	13.05	13.66	14.03
NWP-23	8.74	9.08	9.54	9.96	10.22	10.29	10.61	10.80	Cap frozen	12.74	13.26	13.45	13.68		15.19	15.13	15.78	15.75	16.11	16.45	17.50	16.95	17.11	14.12	15.13	15.44
NWP-24	17.21	17.48	17.72	18.05	18.09	18.14	18.33	18.61	18.93	20.20	20.61	20.74	20.90		22.65	23.33	24.09	25.25	25.72	25.83	Dry	Dry	Dry	Dry	Dry	Dry
NWP-25	15.56	15.73	15.98	16.22	16.52	16.71	17.00	17.11	17.39	19.61	20.42	20.66	Dry		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	16.06
NWP-26	18.79	18.96	19.27	19.78	20.06	20.08	20.31	20.28	20.18	22.16	23.06	23.30	23.48		24.14	24.93	25.15	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Destroyed	Destroyed
NWP-27	8.36	8.63	9.18	9.74	10.13	10.12	10.32	10.49	10.73	12.77	13.56	13.72	14.43		15.84	16.22	16.47	17.19	17.44	17.56	18.15	18.36	18.41	18.19	17.75	17.69
NWP-28 shallow	7.18	7.39	7.83	8.31	8.50	8.55	8.83	9.17	Cap frozen	11.62	Dry	Dry	Dry		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
NWP-28 deep	8.56	8.79	9.32	9.97	10.46	10.57	10.75	10.94	Cap frozen	13.15	13.95	14.13	14.51		15.96	16.31	16.55	17.29	17.53	17.64	18.23	18.42	18.48	18.28	17.83	17.76
NWP-29	9.90	9.74	9.84	10.33	10.68	9.95	10.25	10.89	10.86	12.10	13.10	13.21	14.74	15.26	15.55	16.34	16.30	15.76	16.43	15.8	15.45	16.85	16.41	11.51	13.37	13.33
NWP-30	12.95	13.30	13.84	14.75	15.42	15.86	16.53	16.83	17.65	20.87	Dry	Dry	Dry		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
NWP-31 (4")	9.00	9.30	9.74	10.13	10.48	10.55	10.90	11.06	Cap frozen	12.71	13.13	13.30	13.61		14.62	14.23	15.04	14.45	15.08	15.77	17.13	15.41	16.05	12.50	13.49	13.96
NWP-32 (4")	3.60	6.19	6.27	9.60	9.74	9.65	10.50	11.07	11.69	11.60	Dry	Dry	Dry		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
NWP-33 (4")	4.03	4.36	4.46	4.48	4.17	4.20	5.30	5.76	6.30	8.18	9.49	9.76	10.33		11.45	12.60	13.01	13.97	14.60	14.82	14.60	15.30	15.53	12.45	13.77	14.11
NWP-34 (4")		6.73	7.03	7.37	7.68	7.80	8.01		Inaccessible	9.23	10.55	10.80	11.33	Mud		11.41	11.76	11.93	12.09	Dry	11.69	11.83	11.93	9.63	10.42	10.94
NWP-35		14.69	14.97	15.19	15.52	15.67	15.86		Inaccessible	15.42	Dry	Dry	Dry	15.69		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	14.12	15.33	15.99
NWP-36		10.16	10.27	10.34	10.50	10.54	10.64		Inaccessible	12.30	12.69	12.75	12.92	12.46		12.73	12.92	12.64	13.04	13.14	12.80	13.95	13.16	10.50	11.72	12.15
NWP-40												18.95	19.29	19.48	19.59	19.93	19.90	18.67	19.06	18.66	18.14	19.20	18.87	14.89	16.28	15.87
NWP-41												22.27	22.22	22.38	22.40	22.60	22.61	21.13	21.24	20.85	18.86	20.50	20.31	13.55	15.25	15.02
NWP-42												22.58	23.45	25.92	25.45	25.83	Dry	25.73	Dry	Dry	Dry	Dry	Dry	18.53	22.40	23.00
NWP-43												5.75	6.11	5.04	5.38	7.80	8.53	7.00	9.69	9.68	8.21	10.12	10.24	4.92	6.21	6.46
NWP-44												Dry	Dry		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
NWP-45												Dry	Dry		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
NWP-46												Dry	Dry		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	18.74	Dry	Dry
NWP-47												8.30	8.49		8.38	8.83	8.63	8.70	9.26	9	8.86	9.51	9.30	8.46	9.11	9.02
NWP-48												15.39	16.02		15.7	16.65	17.04	16.59	Dry	Dry	Dry	Dry	Dry	14.22*	15.89	16.17
NWP-49												18.55	19.42		18.69	20.00	20.60	20.15	21.54	21.97	21.90	22.29	22.56	17.67	19.42	19.74
NWP-50												10.07	11.16	10.03	10.04	11.21	12.02	11.54	Dry	Dry	Dry	Dry	Dry	7.34	10.34	10.76
NWP-51												21.05	21.78	19.56	19.81	20.97	Dry	Dry	Dry	Dry	20.60	22.03	Dry	19.05	21.28	Moist
NWP-52													15.58	15.95	16.16	16.80	16.72	15.92	16.42	15.88	15.34	16.71	16.26	13.58	14.06	13.54
NWP-53													14.68	15.32	15.50	17.08	17.15	16.33	16.43	16.43	15.81	Dry	16.86	12.06	13.75	13.60
NWP-54													12.84	12.74		13.49	14.30	13.42	14.60	14.98	13.83	Dry	14.99	9.85	11.87	12.04
NWP-55													19.32	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	19.30	19.05
NWP-56													17.37	18.39		18.56	18.83	19.59	19.70	19.93	Dry	Dry	Dry	Dry	Dry	Moist
NWP-57													16.24	17.61		17.98	18.23	18.77	18.91	19.07	19.37	19.50	19.58	19.73	19.42	19.49

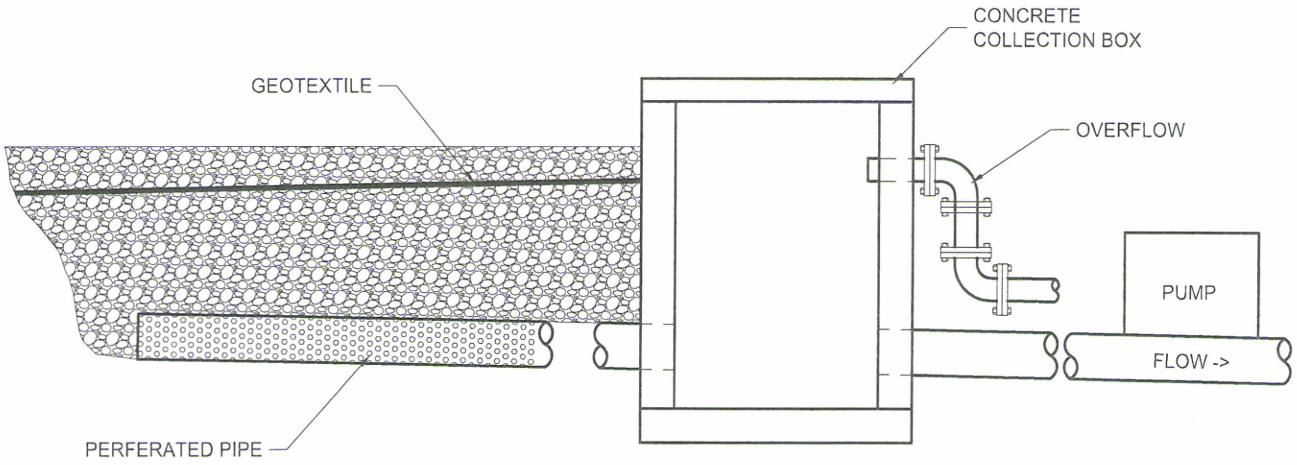


REVIEW COPY

Canyon Fuel Company, LLC
SUFCO Mine
597 South SR 24 - Salina, UT 84654
(435) 286-4880 Phone
(435) 286-4499 Fax

12 NORTH WATER MITIGATION		
SOLAR PANEL		
SCALE: N.T.S.	DATE: 7/12/2012	DRAWN BY: T.R.B.
ENGINEER: J.B.	CHECKED BY: A.R.	PROJ: ####
FILE NAME: H:\DRAWINGS\MRP\12_NORTH\12N_WATER_MITIGATION.dwg		

SHEET NO.
C502



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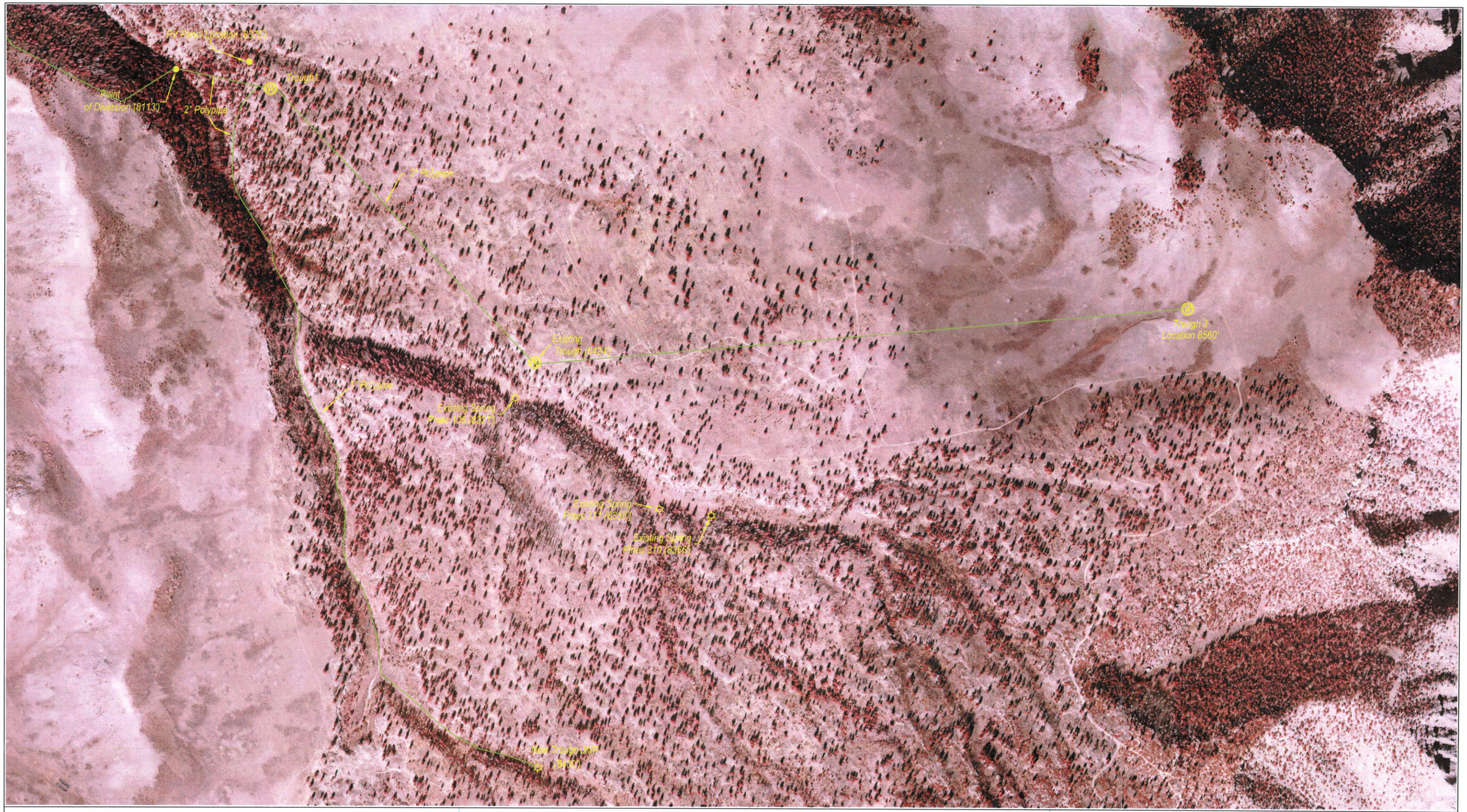
Canyon Fuel Company, LLC
SUFCO Mine
597 South SR 24 - Salina, UT 84654
(435) 286-4880 Phone
(435) 286-4499 Fax

12 NORTH WATER MITIGATION		
SP-89 SPRING BOX		
SCALE: N.T.S.	DATE: 7/12/2012	DRAWN BY: T.R.B.
ENGINEER: J.B.	CHECKED BY: A.R.	PROJ: ####
FILE NAME: H:\DRAWINGS\MRP\12_NORTH\12N_WATER_MITIGATION.dwg		

SHEET NO.
C501



Canyon Fuel Company, LLC
SUFCO Mine
397 South 800 West - Salina, UT 84654
(435) 286-4880 Phone
(435) 286-4499 Fax

East Fork Box Canyon Stock Watering

Figure 3

SCALE:	DATE:10/3/2011	DRAWN BY:F.L.R.	ENGINEER:F.L.R.	CHECKED BY:F.L.R.

FILE NAME: H:\DRAWINGS\MAPSURF\EAST FORK BOX\StockWater\dwg\StockWater2011.dwg

REVISIONS

NO.	DATE	REQ. BY	DWG. BY	REMARKS
1	10/03/11	F.L.R.	F.L.R.	

SHEET NO. 1

Canyon Fuel Company, LLC
SUFCO Mine
397 South 800 West - Salina, UT 84654
(435) 286-4880 Phone
(435) 286-4499 Fax

Figure 4

2010 Northwater Mitigation Proposed Water Line

SCALE: 1" = 1000' | DATE:6/11/2010 | DRAWN BY:K.B.B. | ENGINEER:F.L.R. | CHECKED BY:F.L.R.

FILE NAME: H:\DRAWINGS\MAPSURF\EAST FORK BOX\StockWater\dwg\2012 Mitigation.dwg

REVISIONS				
NO.	DATE	REQ. BY	DWG. BY	REMARKS
1	05/27/10	F.L.R.	K.B.B.	LOCATED SPRING 89
2	06/11/10	F.L.R.	F.L.R.	ADDED WATER LINES
3	07/12/12	A.R.R.	A.R.R.	CHANGED WATER LINES

SHEET NO. 1

APPENDIX 5-9

Reclamation Bond Estimate

Bonding Calculations

Direct Costs		
Subtotal Demolition and Removal	$1,230,568.00	
Subtotal Backfilling and Grading	$548,005.00	
Subtotal Revegetation	$171,967.00	
Direct Costs	$1,950,540.00	
Indirect Costs		
Mob/Demob	$195,054.00	10.0%
Contingency	$97,527.00	5.0%
Engineering Redesign	$48,764.00	2.5%
Main Office Expense	$132,637.00	6.8%
Project Mainagement Fee	$48,764.00	2.5%
Subtotal Indirect Costs	$522,746.00	26.8%
Total Cost	$2,473,286.00	
Escalation factor		0.012
Number of years		5
Escalation	$152,002.00	
Reclamation Cost Escalated	$2,625,288.00	
Bond Amount (rounded to nearest $1,000) 2016 Dollars	$2,625,000.00	
Posted Bond	$2,874,000.00	
Difference Between Cost Estimate and Bond	$249,000.00	
Percent Difference	8.66%	

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Ambulance Garage																			$2,504.00
	Belt Deicer Tank																			$13.00
	Blast Channels A																			$143,211.00
	Blast Channels B																			$53,488.00
	Bulk and Used Oil Storage																			$1,518.00
	Cap Magazine																			$22.00
	Chlorinator Bld																			$18.00
	Covered Storage*																			$0.00
	Diesel Tank																			$995.00
	Drainage Culvets																			$25,340.00
	Electrical Bld																			$602.00
	Fan																			$8,435.50
	Fire Water Tank 300000 Gal																			$11,126.00
	Fuel Dock																			$928.00
	Guard House																			$349.00
	Loadout Belt																			$2,593.00
	Lower Stacker Coal Storage																			$2,149.00
	Lump Coal Belt																			$533.00
	Lump Coal Storage																			$2,139.00
	No 1 Belt																			$3,404.00
	Office Building																			$67,377.00
	Pavement Removal																			$29,153.00
	Powder Magazine																			$22.00
	Pulley Racks *																			$0.00
	Pump Houses																			$972.00
	Riprap Filter Fabric																			$259,568.00
	Rock Dust Bin																			$3,557.00
	ROM Coal Storage																			$21,139.00
	ROM MCC Bld																			$1,022.00
	Sampler Building																			$991.00
	Sand and Salt Storage																			$2,905.00
	Seal Portals																			$62,400.00
	Sediment Trap																			$1,533.00
	Septic Tanks																			$0.00
	Shelves *																			$0.00
	Shop and Warehouse																			$157,104.00
	Shop Garage																			$11,941.00
	Shop Office																			$2,322.00
	Side Release Tank																			$161.00
	Steam Cleaner Building																			$7,713.00
	Stoker Belt																			$1,104.00
	Stoker Bin																			$6,755.00
	Stoker Coal Storage																			$3,127.00
	Stoker Oil Tanks																			$1,539.00
	Storage Trailers																			$1,256.00
	Substation Lower*																			$76,628.00
	Substation Upper*																			$0.00
	Ticket Printers																			$69.00
	Tipple Building																			$36,194.00
	Tipple MCC Buidling																			$2,759.00
	Tipple Office Building																			$3,161.00
	Transfer Building																			$10,303.00
	Trash Pit																			$542.00
	Truck Loader Bin																			$1,895.00
	Truck Scale																			$36,352.00
	Water Tank Upper																			$0.00
	Water Tank Lower																			$0.00
	West Lease Tunnels & Belt																			$83,424.00
	Yard Hoist																			$945.50
	Northwater Mitigation																			$4,117.00
	Link Canyon Facilities																			
	Link Canyon Portals																			$8,042.00
	Link Canyon Substation																			$39,150.00
	Fourth East Facilities																			
	Fan Generator Building																			$2,591.00
	Four East Fan																			$18,066.00
	Mine 1 Pad																			$3,301.00
	Total																			$1,[illegible]

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Northwater Mitigation																			
	Structure's Demolition Cost	Pipe Removal	02220 110 0012	0.31	/CF						10269					CF		10269	CF	3183
	Structure's Vol. Demolished																0.1	38	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity										16					CY		2	Trips	
	Haulage													3		Trip/Day				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01590 200 5300	718.44	/day													0.7	DAY	503
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	Trhv	$50.55	HR													5.6	HR	283
	Disposal Cost Steel																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	11.38	/CY						5					CY		5	CY	57
	Concrete's Vol. Demolished																1.3	7	CY	
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.06	/CY													7	CY	7
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	02315 490 0320	2.9	/CY													7	CY	20
	Disposal Costs	On site disposal	02220 240 5550	9.15	/CY													7	CY	64
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			